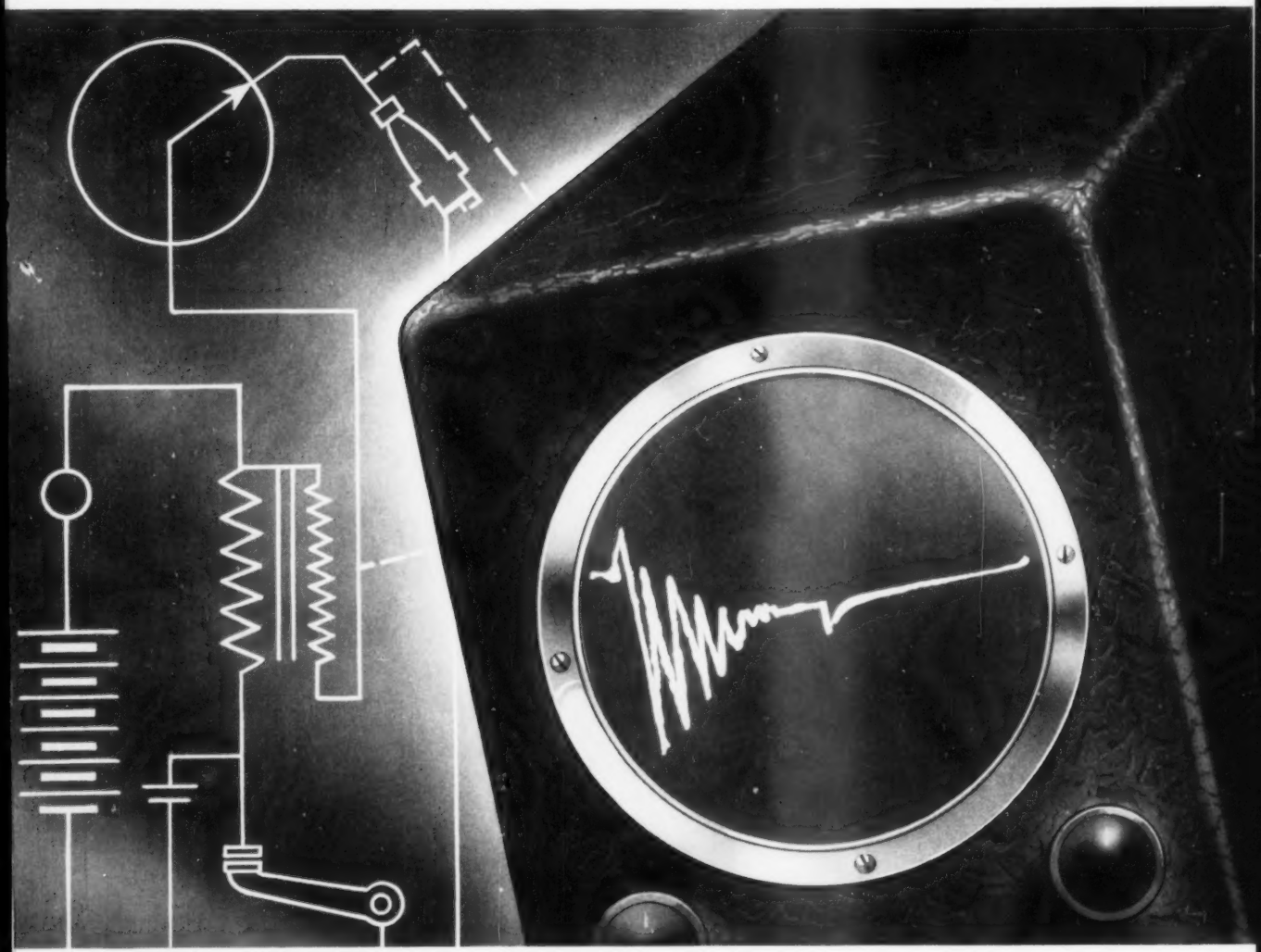
Automotive Service Digest

Our 46th year

January, 1958



Oscilloscopes—Seeing eyes of ignition—Page 38

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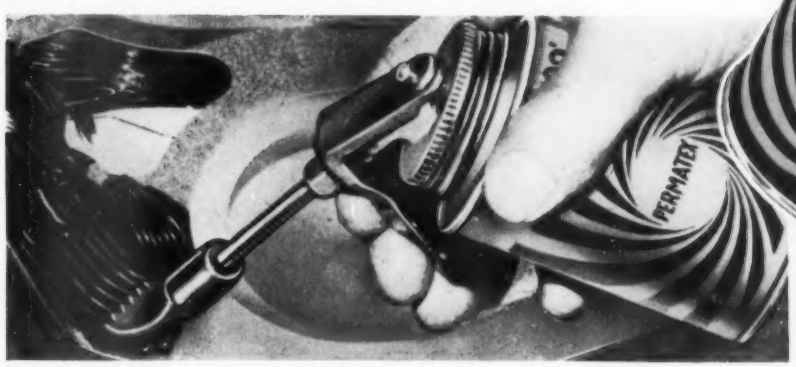

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Chevrolet...	14	6	20	40
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*National Association for Stock Car Auto Racing

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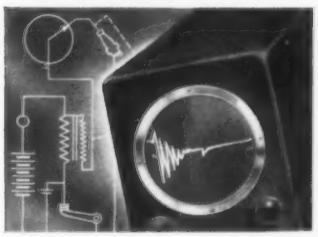
Automotive Service Digest

January 1958



Cover

Just as the cardiogram shows human heart action so does the trace of an oscilloscope show the pulse beat of the spark ignition engine.

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For February

● The widely used expression "Tune-up" is defined in many ways; some of them baffling to customers and service shopmen. Tune-up depends, to a great extent, on the way a shop operates, and above all, there must be a definite understanding with the customer as to exactly what he is getting for his money to avert comebacks and dissatisfaction. Clarification of this will appear in the February issue with the article "What Kind of a Tune-up."

● Magnetism and magnetic forces have long been familiar to automotive mechanics. But using magnetic forces to detect cracks in engine and chassis parts may not be an application some have used. Coming up in the February issue will be an informative article on how to save time, money and comebacks by using electricity to check parts before assembly.

● Our readers certainly will literally eat up the excellent article covering in detail the construction, operation and servicing of the Powerglide transmission. This series on automatic transmissions has made a hit since its inception with the September, 1957, issue. Historically, Chevrolet turns out huge numbers of cars per year and this makes a working knowledge of Powerglide service especially valuable.

Are you still playing the

"Should I put in colder plugs for high-speed highway driving?"

Why gamble when POWER TIP

IN TOWN TRAFFIC . . . *Some spark plugs, designed for high speeds, become fouled and cause misfiring and loss of power when driven at low speeds.*

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spark plug "guessing game"?

"Should I put in hotter plugs for low-speed city driving?"

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Smart dealers know they can depend on Auto-Lite Power Tip to protect their most valuable asset . . . customer satisfaction. That's because Power Tip "fires up" today's overhead-valve engines at *all* speeds—and *keeps* them "fired up" in all kinds of driving. More and more dealers are *standardizing* on Power Tip for all overhead-valve engines because it takes the "guesswork" out of spark plug selection. The new, simplified wall chart shows the *one* Power Tip number that's *best* for each of America's 19 makes of passenger cars.

Install Power Tip in your customers' cars. Take the "guesswork" out of your spark plug service and be *sure* of completely satisfying your customers. Stock Power Tip *today!*

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Ben Ikert, Editor

Ball Joint Wear

Every time I check the lower ball joints on a Chevrolet there seems to be far too much play in them to give proper alignment and car handling. Although I have replaced a good many of them, it seems that the same condition exists with the new joints, too. Are there any specific tolerances to adhere to when checking these joints?—*L.O., Waterbury, Conn.*

Answer: The amount of play on the ball joint suspension should be no more than with the old style steering knuckle and steering knuckle support with a king pin on each side. This should be tested with the weight of the front of the car on the suspension, checking by pushing firmly on the top of the tire to see if there is free sidewise movement.

The weight of the front end of the car hangs on the lower ball joints so they will be more likely to wear than the upper ball joints. It may be a matter of lubrication if there is excessive wear on the lower ball.

We do not know of anything that can be done other than to replace the worn parts. Car owners should be warned to have the car greased every 1,000 miles faithfully. In putting in the new parts, be sure all the lost motion is taken out at the time.

Which Car Will Stop First

In your October, 1957 issue you had a very interesting article on "Which Car Will Stop First." Incidentally, I agree with your answer 100%, but if I were to make a wager on the subject, I would choose the car without the battery.

I say this because I mounted a Ford generator (2 brush) and a Ford regulator on a garden tractor to light two 5" clear fog lights and a taillight. The tractor is used to plow snow during the winter months and so far it has seen one season of use.

Realizing that if the voltage regulator points should stick momentarily the lights will burn out (due to the voltage rising to about 20 volts without a battery in the circuit), I put a 20 amp fuse in series with the lights. Now my problem is . . . if the points do stick, which will burn out first—the lights or the fuse? The reason I chose a 20 amp fuse was this: The lights are rated 6 to 8 volts. At 6 volts they draw 16 amps, so at 8 volts the amperage would go to about 21.3 amps, which is above the rating of the fuse. Another thought is, could I adjust the current regulator at a rating somewhere above 16 amps and below 20 amps?—*R.B., Highland, N. Y.*

Answer: There is no arguing with experience, so if your garden tractor ran for a whole season without a battery, apparently the generator and regulator can function in this way.

However, the writer would be inclined to take a chance on the battery without a generator rather than a generator and regulator without a battery, since the results with the battery could be pretty well predicted, while with the other combination the results would be doubtful.

We think your choice of fuse size at 20 amps is a good one. You should be able to adjust the current limiter to keep the current between 16 and 20 amps. The only hitch is whether the resistors in the regulator could keep the current down to the normally regulated value without the ballast of a battery in the system.

Power Steering No Help

The owner of a 1953 Cadillac Model 62 equipped with power steering complains that too much effort is required to steer the car. Can the relief valve be removed from this unit so as to give him constant power steering?—*L.M., Courtland, Wis.*

Answer: Do not remove the relief valve, as this will only cause trouble and will not give constant power steering. The probable trouble with this car is misalignment of the steering gear.

Jack up the front wheels to remove the load on king pins and tires against the ground, and with the pump operating check the steering response.

Loosen the bolts that hold the steering head to the frame and check to see that the natural unforced position is perfectly parallel to the frame. If not, the steering column may be bent. Check all the way to be sure there is no binding or misalignment. This gear should give easy steering if there is no unusual drag.

Also check the actuating valve to be sure it is working freely, and be sure the pump is maintaining full pressure.

Blows Its Anti-Freeze

When one of our customers is driving his 1949 Reo 3-ton truck (temperature normal) the engine suddenly vomits from 4 to 5 quarts of its coolant all in one shot through the overflow and pressure cap. It's as though a big pressure builds up all of a sudden. This gets to be pretty expensive in winter (replacing the anti-freeze), as well as dangerous.

The engine was recently overhauled and radiator and block were thoroughly cleaned. Since then I have removed the water pump and examined it carefully, but it is perfect. I put in a new thermostat and installed new pressure cap (4 lbs.), but still this engine "vomits." Have checked the radiator for circulation (it is not clogged) and hoses are in good condition.

Can you give me a clue as to what is wrong?—*L.C., Donnelly, Alta, Canada.*

Answer: In a case like this we must first start with the fact that for some reason a pressure is built up at times in the cooling system, since the only way coolant will be discharged is from pressure which may be from steam, air or cylinder gases under pressure from combustion.

You do not give any information about temperatures. This should be watched to see what the temperatures are when the blowing occurs. It is possible in an 8 year old engine that there are deposits in the water jacket which under certain conditions pre-

(Continued on page 70)

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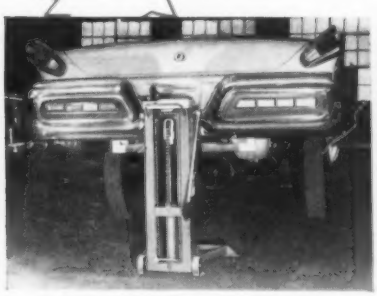

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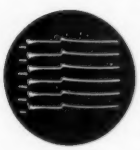

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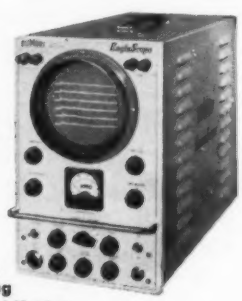

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Editor's page

1958 general business outlook is good

● A GENERALLY HEALTHY 1958 business outlook was revealed in a recent poll of America's business paper editors. This, in spite of a current wave of pessimism. Sixty editors of publications belonging to the Associated Business Publications, speaking for forty-six different industries, provided their impartial views in an economic outlook survey conducted by ABP.

Ninety two percent of the editors who make definite 1958 forecasts in the respective fields they serve predict business will either increase slightly or hold steady as compared with 1957. About 70 percent predicted increases and 22 percent no change. The remaining 8 percent were of the opinion that their fields will not fare as well in 1958--industrial air conditioning, machinery, metals and railroad car loadings, for example.

As to the 1958 trend in labor costs, approximately 77 percent of the reporting editors forecast a rise in such costs, about 18 percent predicted no appreciable change and a little over 5 percent forecast a decrease. Nearly 60 percent looked for a shortage in manpower, the other 40 percent reporting that the supply of manpower will increase or remain substantially the same.

Another source points out that automobile dealers in this country have a potential market of over 20 million new and used cars for 1958. That is the belief of Alan G. Rude, president, Universal C.I.T. Credit Corp., and who bases this on the premise of 11 million people coming out of automobile debt in '58; 4 million cars being scrapped; rapid advance of the two-car ownership and several million prospects with no automobile debt.

Lowering of re-discount rates is a stimulus for commercial banks to borrow more money, which in turn can be passed on to individuals for consumer spending. Thus, with fewer restrictions on credit, more automobile paper should be forthcoming.

Predicted on increased government spending for an enlarged missile program, revised estimates of the nation's economy for 1958 indicate that the top 1958 sales forecast by the motor car industry's economists—6.2 million cars—stands a chance of being met.

Regardless of the 1958 car sales, the motor vehicle industry in all its ramifications will continue to reflect the nation's economic state as it has done in the past. There exists a good reason for this. One of every six businesses and one of every seven gainful workers in the nation are dependent for a livelihood on the manufacture, distribution, servicing and use of motor vehicles. The fact is, the nation's economy probably would falter if divested of the billions of dollars forthcoming annually in retail automotive sales.

Ben Ikert
EDITOR

A must in every mechanic's tool box should be a torque wrench. This particular wrench is of such design that when the specified torque is applied, the outer end of the handle releases and bends so no more torque can be applied.

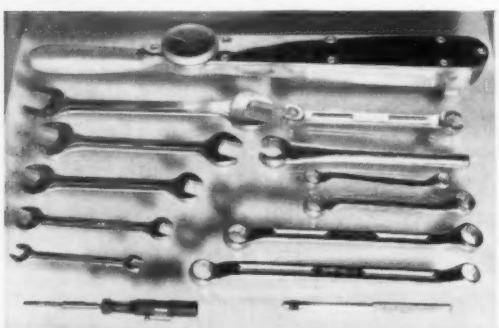
By FRANK WEST

Automotive service work, of necessity, requires countless tear-downs, adjustments, fittings and re-assemblies. These take time and effort, both of which can be materially reduced when mechanics have . . .

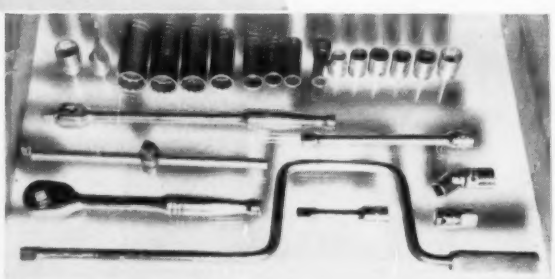
The right tools on hand for the job

• IF YOU HAD NO "working tools" when you sat down at the dinner table —that is, no knife, fork and spoon— you could still eat by using your fingers. It would be slightly messy— but you wouldn't go hungry.

By the same token, if automotive service mechanics did not have at least a minimum of certain basic hand and special tools, they would go hungry for the simple reason that they could *not* work without them; and no pay, no groceries, which leads to the obvious conclusion that tools are more essential when doing service work on automobiles than realized.



At the left of this picture are typical open end wrenches; on the right single and double end tubing fitting nut wrenches and typical double end box wrenches. At the rear is torque wrench, while down in front are shown a spark-plug testing screw driver with a screw starter.



A set of ⅜" drive sockets and drivers. On the right are a ⅜"-½" adapter and universal joint with socket in place. At the rear is a set of deep ⅜" drive sockets and the standard 12-point sockets, with a drag link adjuster.

PURCHASE THEM WITH CARE

Since tools are the number one requirement for doing mechanical work, those purchased should be the most comfortable to use, the most durable, the fastest to work with and the most versatile and convenient. Speed that can be made by using the most suitable tools is important since so much work, especially in car dealer shops, is done on a flat rate basis. This means that with payment to the mechanic being made for the job being done instead of the hours actually worked, the faster the job is done the higher will be the average hourly earnings. And having the right tool for the job is a big factor in this.

TWO GENERAL TYPES OF TOOLS

Hand tools can be divided into two general types: conventional and specialized. With the advent of the V-8 engine, plus complications in the way of power steering equipment, power brake mechanism, and the increasing use of air conditioning units, under-the-hood work is getting more difficult year by year. There has always been need for specialized hand tools, but now more are required than ever before.

Basic requirements for conventional hand tools in shops should include a set of each of the three drive sizes of sockets—¼", ⅜" and ½" with ratchet, nut spinner, speeder handle and sliding bar driver, in each size; open end wrenches from ¼" to 1¼"; box end wrenches from 7/16" to 1"; screw drivers that will fit the several different types of screws being used; pliers of different kinds; diagonal cutter; vise grip pliers; drive, pin and center punches; cold chisels; hack saw; a variety of hammers and so on.

There is a fairly wide spread in tool prices, and quality and value vary accordingly. Understandably, when one is using tools all day long, day after day, only high grade, quality tools are the most economical, since they will last longer and work better. Accuracy in dimensions, clean-cut design, good finish and strength to withstand the stresses that sometimes run very high, make for satisfactory tools. Lack of any of these qualities can be responsible for lost time, skinned knuckles and bad temper!

Tool manufacturers have developed lines of standard and special tools to fill the needs of shops for every job requirement. The conventional tools, such as sockets and their drivers, end wrenches, pliers, screw drivers, etc., are pretty well standardized as to general design, and their selection is much like an individual selecting an automobile. All well-known companies make good tools, so that the ones that are picked out by shops or mechanics are largely a matter of individual taste, or possibly a matter of the convenience of the supplier or the completeness of his stock.

SPECIALIZED TOOL DESIGN VARIES

Specialized tools will vary in design and availability. That is, some of the tool manufacturers will specialize in one type of tools, as, for example, tools for automatic transmissions, for power steering system, etc. Therefore, it pays for those who use tools to be as familiar as possible with the offerings of the manufacturers. The specialized tools for certain engine operations, front end work, carburetor work, steering system work, etc., are literally worth their weight in gold in the time they will save in doing what would otherwise become almost impossible jobs.

There are mechanics who feel that automobile designers sit up nights working out constructions that are tough to work on. Apparently the difference between putting an engine together when it is easy to get at on all sides on a production line and working on the same engine when it is under the hood of an automobile is quite marked. Even with the specialized tools that can be used, it often takes considerable skill and ingenuity to do certain necessary service operations and keep down the elapsed time to a minimum.

Some of the less common tools that are available are worthy of mention. Stud pullers, for example, come in handy in connection with engine work. There are several different kinds, such as cam, wedge type and collet type. The collet type makes use of a threaded collet for each size which tightly grips the thread, and will both remove and reset studs. Collet sizes run from No. 10 machine screw to 1½" diameter screw threads.

TORQUE WRENCH A MUST

A torque wrench is a must in each mechanic's tool kit. Sizes run from ¼" square drive, with a rating of 0-15 in. lbs., to 1½" square drive rated at 0-4,000 ft. lbs. Car makers include torquing limits in their service manuals, and these should be followed on all jobs.

Some typical tools of recent vintage that will prove useful and profitable are: Chevrolet king-pin driver for 1954 and earlier models; pitman arm puller for 1956 Ford products and some other cars and pick-up trucks; Chrysler-line offset distributor wrench for distributor bolts on 1954-'57 8-cylinder engines; Ford ball-joint separator for 1954-'57 Ford and Mercury and 1952-'57 Lincoln.

Others include a brake wrench for 1956-'57 Chrysler and DeSoto; manifold-bolt torque adapter for exhaust manifold bolts on Continental, 1952-'57 Lincoln, 1954-'57 Mercury and Ford V-8; midget double hex sockets, ¼" square drive; Ferret ⅜" square drive, single hex deep sockets.

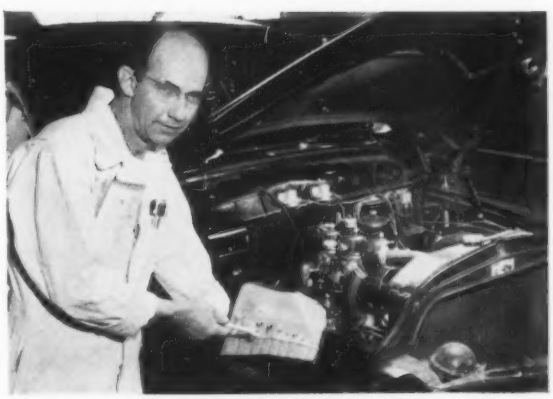
Still others are deep 13/16" spark plug socket with rubber insert to hold and center the socket on the plug to minimize plug breakage on removal or insertion; spark plug jack—a 3½" brass extension for extending a spark plug so timing light clip may be clipped onto jack; point adjusting tool for late model Delco-Remy distributor adjustment; set of screw starters —to hold screws so they can be readily started in inaccessible places . . . and literally countless other tools of equal importance. The illustrations in this article are typical of such tools.

For those who service carburetors there are available all the necessary tools for Stromberg, Carter, Holley, Rochester and other carburetors. There are also standard tools recommended for carburetor work which are convenient to have on hand.

The midget ¼" drive sockets with

(Continued on following page)

Using a power impact wrench fitted with a universal joint socket for removing cylinder head studs or nuts. The universal joint feature speeds up the job.



For working on distributors, carburetors, generators, etc., a set of tiny wrenches is indispensable.

Wheel pullers are urgently needed tools when stubborn rear wheels have to come off. Here is a puller that will remove Ford rear wheels from the axle shaft with minimum time and effort.

Tools . . . CONTINUED

their straight plastic grip handle, speeder driver, ratchet, nut spinner, and sliding bar driver are essential for work on electrical equipment and other small parts. The sockets range in size from 3/16" to ½" (wrench size), and there are screw driver sockets of standard, Phillips and clutch type.

For many, if not most of the operations on a car, the ⅜" drive sockets are more convenient to use than the ½" drive sockets. The usual four types of drivers should be included in all tool kits as each has its useful application. These drivers are: ratchet, speeder, nut spinner and sliding bar. A universal joint attachment gives access to some cap screws or nuts that cannot otherwise be tightened or loosened.

SPARK PLUGS OFTEN A PROBLEM

For removing and replacing spark plugs on Ford, Mercury and some other engines, the recess around each plug is too small to allow the use of the standard ½" drive deep socket, and therefore deep sockets with their thinner walls should be used. When plugs are hard to loosen up, as is often the case with the 18 mm gasketless plugs used on Ford products (located down under the exhaust manifold) a ½" drive nut spinner with a ½" to ⅜" adapter to get ample turning power on the ⅜" drive deep socket should be used. After the plugs are loose, they can be easily and quickly removed with the ⅜" drive ratchet. This will prevent skinned knuckles and possibly burned hands. Deep sockets of the most commonly used sizes should be on hand. Since square nuts are encountered now and then, square sockets (7/16", ½", 9/16" and ⅝") will be needed to handle them. These are 8-point sockets.

Special distributor nut wrenches, tool for breaker points and voltage regulator adjustments (lower left), thickness gauge and special small pliers—all very useful for the tool box of the tune-up mechanic.

An old stand-by — the ½" drive set of sockets, both standard and deep, with one style of ratchet driver, an extension and a nut spinner.

12-POINT SOCKETS CONVENIENT

Both 6-point and 12-point sockets are available for driving hex head cap screws and hex nuts, in both the standard and deep socket designs. The 12-point sockets are a little more convenient to use than the 6-point since when changing the position of the socket on the nut or screw head it is only necessary to move the socket 30° to get a new "bite" on the driven hex.

The ½" to ⅜" adapter was previously mentioned. In addition, there are other adapters that can be used to advantage on some jobs. These are ⅜" to ¼", ¼" to ⅜" and ⅜" to ½", in which the first mentioned size is the driver size, and the second figure the socket size.

Screw driver sockets can be had in four different types and in a selection of sizes—standard for straight screw slots, Phillips, hexagonal for recessed head cap and set screws, and clutch type. By the way, clutch type screws (sometimes referred to as "butterfly" or "figure 8" screws) are being used in increasing numbers, as they have certain advantages.

Pipe plug sockets to fit plugs with 9/32", 5/16" and ⅜" square shanks and male sockets with 5/16" and ⅜" square projection will remove or insert plugs of the respective sizes mentioned, which otherwise are often difficult to get out.

POWER WRENCH SAVES TIME, TEMPER

An interesting tool is the impact driver kit or set which is designed to handle the tough, ornery job . . . as well as speed up the removal and installation of nuts and bolts. It consists of the driver and an assortment of sockets from 5/16" to ⅝" and screw drivers of various kinds and sizes. The driver is struck with a hammer and delivers a rotary impact blow in either direction. Its powerful action will loosen screws and bolts even when they are wedged or rusted in place, or will tighten them so they will stay tight, with minimum danger of twisting them off. Some of these power impact wrenches are designed to drive nuts and bolts to a pre-determined torque so that uniform tightness is assured.

Mention should also be made of the well-known ½" drive sockets and their drivers, and the desirability of including a universal joint and a set of extensions of the most needed lengths, which will be between 2" and 36".

For truck work and other heavy

machinery, ¾" sockets and drivers are used, and for still heavier duty, 1" drive sockets are available with ratchet and sliding bar drivers. ¾" drive sockets run in size from ¾" to 2⅜" and the 1" drive sets go from 1-7/16" up to 3⅛".

OPEN AND BOX END WRENCHES

In the wrench department, we have box end offset types in both single broached and double broached ends . . . that is, 6-point or 12-point. The single hex series has a range of 3/16" to 11/32" in the midget set and ¼" to ⅝" in the 6-point dwarf group. The 12 point series runs from ⅜" to 1⅝".

Box wrenches have the same advantage as sockets in that both apply pressure on six corners of the hex nut or hex head cap screw to which they are applied. They will not spread, since they encircle the part.

Large size striking sockets are available for sizes from 1-1/16" up to 3⅛". These big boys are provided with an anvil for striking them with a hammer of suitable size to turn them.

A group of wrenches especially useful when working with tubing fittings is a flare nut set. These are valuable for tightening and loosening (particularly loosening) the nuts on tubing fittings. They are similar to heavy box end wrenches except that they are cut out so they can be slipped over the tubing to contact the nuts. The double ends provide two sizes on each wrench.

We must not overlook the several sizes of Allen wrenches, or standard hex head wrenches for driving recessed hex head screws in sizes from 3/64" to ¾"; though for automotive work, from 1/16" to ⅜" will cover most requirements.

The final group of fixed wrenches (not adjustable) is the well known open end wrench. This type comes in several forms: (1) the standard design with jaws offset 15° so that by turning the wrench over where space is limited, 30° of movement will allow getting a new grip on the nut or screw head; (2) tappet wrenches, which are longer and thinner; (3) ratcheting open end, which has one short jaw on each end to allow the same action as you would get with a ratchet.

A comparatively new type open end wrench is also available which applies force only on the *flat* sides of either hex or square nuts. There is no danger of rounding the corners or spreading the wrench because it puts pressure where it cannot burr or deform corners. It works easily in close quarters due to the slender head, and seats instantly on battered nuts or capscrews.

While conventional open end wrenches are probably the most used of any of the wrench types, they have the objection that they only apply force to two corners of the hex. This limits their use to those jobs which can be loosened fairly easily. Real tight nuts, like connecting rod nuts or cylinder head nuts, cannot be loosened with open end wrenches, so sockets are used for this purpose.

VARIETY OF SCREW DRIVERS

Screw drivers come in great variety to suit all needs. The standard tip type for use with straight slot screws has been used for many years. Special screw drivers are now used on Phillips screws with cross shaped slots, in four sizes of heads; the clutch-type in six sizes of heads; the R&P type (Reed and Prince) in five head sizes which fit heads with cross slots, but different from the Phillips type and not interchangeable with them.

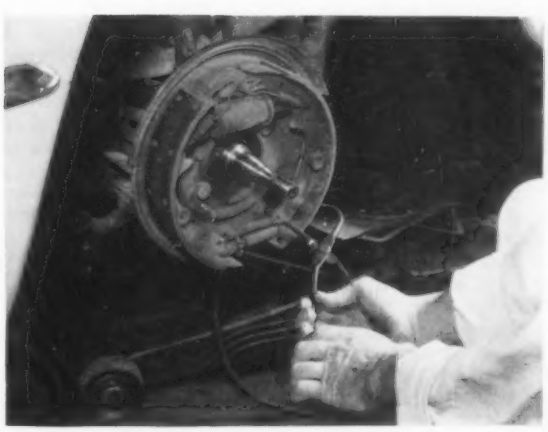
An interesting special screw driver is one designed with a small neon tube enclosed in the plastic handle. When the tip of the blade is touched to the insulated plug contact on a running engine, the neon tube will give a red flash every time the plug fires. With the general use of rubber shields over the spark plugs, it is rather difficult to get at the plugs, though if trouble with plugs is suspected, jacks can be put on the plugs and the test then made with ease. Trouble can also be detected to a certain extent by merely rubbing the blade along the high tension wires and watching the glow in the neon tube.

Punches (drift, center and pin), chisels, and pliers complete the general list of small tools, though we could possibly include adjustable end

(Continued on following page)

Hydraulic valve lifter remover for Buick and Chevrolet engines—a good example of a special tool that does the work which otherwise could be quite difficult and time consuming.

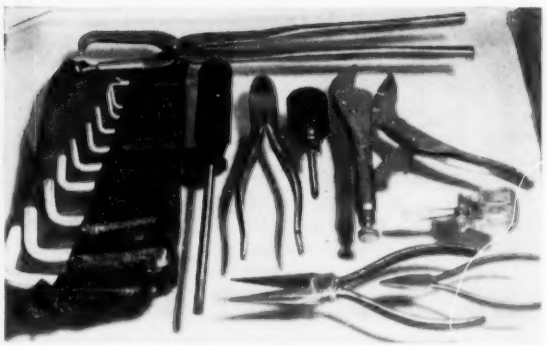
Handy arrangement of ½" drive nut spinner, ½"-⅜" adapter and ⅜" drive deep socket for getting out tight spark plugs.



For those who do brake work, a pair of brake spring pliers is a "must." It's a time-wasting and temper-aggravating job to try to put back springs without a tool similar to the one shown.

Tools . . . CONTINUED

wrenches and pipe wrenches, which have some application in automotive service work—though the adjustable end wrenches are not very good tools when a fixed wrench can be used. The use of the pipe wrench should be confined to turning pipe, pipe fittings and round bars or tubing only—never on nuts or screw heads, except where these have been rounded over so that regular wrenches cannot be used.



Some of the less commonly used, but necessary tools, which should be in every mechanic's tool box.

WRENCHES FOR FOREIGN CARS

With all the foreign cars that are coming into this country, and with increasing numbers in sight, it will be interesting to know that wrenches to fit the metric sizes of screws and nuts used on the German and French cars and the Whitworth Standard screws and nuts on the English cars, are available from tool manufacturers.

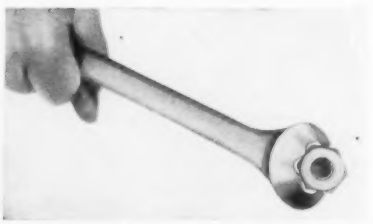
It is doubtful if any list of tools could be made up that would actually be complete, but the various tool manufacturers' lines cover so many kinds and sizes that about any tool needs, except possibly some highly specialized requirement, can be satisfied.

When you look over the tremendous number of tools and appliances used in automotive service work it becomes overwhelming and the purchase of tools can become quite an item. But to do work efficiently, good, suitable tools are needed—and buying them should be considered as an investment which will pay off.

Deep spark plug socket with rubber collar inside which both holds and centers the plug in the socket so as to reduce the chances of breakage.

TAX DEDUCTIBLE

A fact which will lessen the net cost to you for tools is that the cost of tools bought to replace those which have worn out, become broken or "borrowed" can be deducted from your take home pay in figuring your annual income tax. Also, depreciation on any tools that have a normal life of more than one year can be taken on a pro rata basis based on the estimated life of the tools less their scrap value, if any. For example, on tools which last three years, you can deduct one-third of their cost each year, since tools have practically zero scrap value. In this way you can recover approximately 22 per cent of your tool cost. If there is any doubt about how to handle this, the man who helps you with your income tax can work out the details, if he has the facts and the amounts.



A comparatively new type of wrench. This radical design applies force only to the flat sides of either square or hex nuts so there is no danger of rounding the corners and spreading the wrench. The slender head works easier in close quarters, seats instantly, turns better, even on battered nuts and cap screw heads.

Every service manager and all shop mechanics should be familiar with the tools that are available, since having the right tools on hand for the particular kind of work being done will directly affect income. Considerable amounts of money can be tied up in tools, but where they will save time and enable efficient work, it is cheaper to buy them than to try to get along without them. In fact, the modern service picture is such that no shop can get along without the right tool for the job.

Studebaker Adds Two All-New Hardtops

● TWO ALL-NEW HARDTOPS have been added to the Studebaker line—one in the President series, the other in the Commander series.

Both are V-8's. The President has a 289 cu. in. engine rated at 225 hp., and the Commander has a 259.2 cu. in. engine rated at 180 hp. Both engines have a compression ratio of 8.3:1.

Four-barrel carburetion is standard on the President. A power kit with a four-barrel carburetor is available for raising horsepower on the Commander to 195.

Both cars are mounted on a 116.5" wheelbase and are 202" long, 57" high and 76" wide. They have 14" wheels and dual headlights as standard equipment.

Lowness of the cars is said to be due to the new one-piece driveshaft announced this year by Studebaker.

Both hardtop models have self-centering self-energizing hydraulic brakes with finned brake drums. Power brakes are optional as are power steering, automatic transmission and the Twin-Traction, non-slip differential.

A new safety feature is the door panel styling, with the door panels heavily padded beneath the trim. Metal mouldings have been eliminated and replaced by an accent design of raised vinyl, which is said to allow greater safety and a softer, more luxurious appearance.

Studebaker's 1958 President two-door hardtop.

Strongest Thing
IN HOSE CLAMPS

When a mechanic installs an AERO-SEAL
and tightens the precision self-locking worm gear,
that clamp is on to stay—even to outlast the car,
AERO-SEAL originated the precise worm gear drive
and it has imitators but no equal today. Bands are of 302-18-8 stainless steel.
Pressure is applied evenly all 360 degrees around the hose.
No pinching or damaging hose. You can shake the daylights out of AERO-SEAL—
they won't vibrate loose or snap open. They just NEVER let go.
But you can remove them easily and use them over and over.
For happy customers and steady REPEAT profits, insist on AERO-SEAL.

For added quick-attach advantage:

Aero Seal QUICK ATTACH JET HOSE CLAMP

BREEZE MARK

Aero-Seal

REGULAR WORM GEAR HOSE CLAMPS

BREEZE CORPORATIONS INC., 700 LIBERTY AVENUE, UNION, NEW JERSEY

WHEEL ALIGNING NEWS

VISUALINER John Bean STEERING SERVICE PRECISION of MICHIGAN

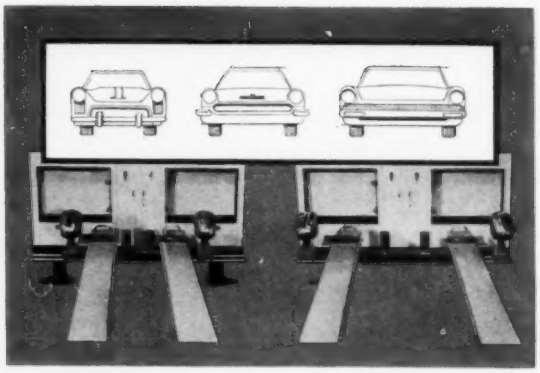
Getting New Profits Out of Old Equipment

With car registrations reaching a new high every month, the capacity of automotive service facilities is being stretched to a breaking point. To keep abreast of this swelling demand, service operators are faced with two choices: (1) purchase additional property to build larger facilities, or (2) modernize their present equipment to increase efficiency. Figures show that 90% of today's aligning operators can add 50% more capacity to their present equipment through modernization. In other words, modernizing can add the equivalent of 100 feet to a 200-foot service area . . . at less than 5% of the building cost! Many ways to modernize your present equipment are suggested on this page . . . many ways to increase your capacity, and get new profits out of old equipment.

One sure way to add new and profitable efficiency is to add Visualiner projection heads and viewing screens available as a changeover unit that is readily adaptable to practically any wheel alignment or frame straightening rack. With Visualiner, the most modern of all wheel aligning methods, you get speed and precision that is unsurpassed. You make all readings in a fraction of the time required with other methods, and perfect corrections are achieved without trial and error. If you are already a Visualiner owner, you will want to investigate the new remote chart controls, easily added to your present unit.

Cut Aligning Time 20%

John Bean's exclusive remote control steering wheel turner adds still greater speed and accuracy to wheel aligning service, cutting time as much as 20%. Manual effort is replaced with automatic control that allows the operator to turn front wheels instantly. Working under the car, over the fender, or standing on either side, he has finger-tip control at all times. Errors resulting from pushing or pulling the wheels are completely eliminated.



Service Any Car, Any Tread Width

Now you can broaden the range of your wheel alignment service to handle virtually all types of cars, including foreign cars of every make, sports cars, passenger cars, and light trucks. All this with a single rack . . . with adjustable runways that move in or out to fit any tread width from 40 to 68 inches. With John Bean universal racks, you not only serve more customers, but you serve them faster. Investigate the conversion of existing Visualiners through installation of the new John Bean adjustable rack. They can be installed economically to utilize existing Visualiner heads and backgrounds.

Many New Tools and Accessories Increase Aligning Efficiency

John Bean now offers many ways to speed aligning service and increase your capacity with minimum investment. One of these is a handy set of steps that attach directly to your aligner for new comfort and convenience in making over-the-fender adjustments. Portable foot-operated air jacks can be added that lift cars instantly in preparation for steering and alignment checks beneath the car. For late-model Chevys, Buicks, and Chrysler cars, new camber correction tools let you increase camber after all shims have been removed. Torsion-Aire suspensions are quickly and accurately adjusted with the new John Bean Model 54 Suspension Height and Level Checking Gauge. These and many other tools and accessories, essential to a complete, modern department are all available from John Bean.

FOR MORE INFORMATION Write today for Bulletins L-1381 and L-1450

JOHN BEAN, Lansing 4, Michigan
Division of Food Machinery and Chemical Corporation

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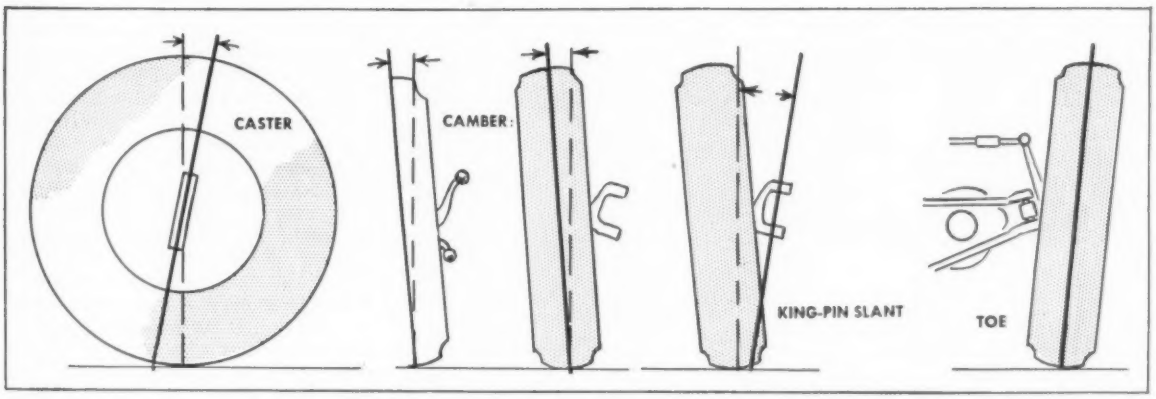


Diagram showing caster, camber, king pin slant and toe.

Over the years the importance of wheel alignment has been stressed, but many shops are still passing up this work because of space restrictions. With today's modern equipment, any shop—large or small—is in a position to . . .

Cash in on front end service

By FRANK WEST

• EVERY ONE OF THE MILLIONS of automobiles on the streets and highways of this broad land had to have caster, camber, toe-in, king-pin inclination and turning radius correctly set before leaving the factory. Of the more than sixty million cars in use, approximately twelve million were built in 1956 and 1957; leaving forty-five to fifty million cars that are now over two years old.

We know from experience that from ten to twenty per cent of these cars should have their front ends checked and correctly aligned, with a certain proportion of them needing replacement of worn parts. Some of these cars will be brought into the shop by their owners, but there are many more whose owners will not take them to the shop for this service. However, when they bring their cars into the shop for other needed repairs, if shop personnel is on the alert for signs of needed front end service, *this service can be sold.*

PASSING UP THE PROFITS

A great many shops are passing up the profits to be had from checking, adjusting and repairing front ends because they think they do not have the room to handle it. Today this is no longer an "excuse," inasmuch as a number of pieces of equipment are now available for handling front end work in a limited amount of space.

To those shops seeking to increase shop profits by cashing in on this much needed service we submit the following "refresher" on the five basic items involved in front end geometry.

CASTER

Caster is the backward tilt of the king pin at the top. The easiest way to visualize this is to think of the fork of a bicycle. It is this caster angle that enables Junior to call out, "Look, Ma, no hands," as he rides his bike and it apparently steers itself.

Purpose: To cause wheels to run straight normally and to reduce steering effort.

Measuring: To measure caster, use is made of the fact that the outer end of the steering spindle describes an arc in a plane at right angles to the

(Continued on following page)

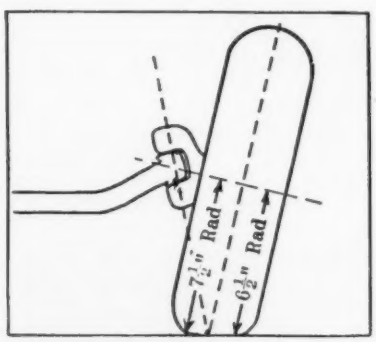
Pit type equipment, such as shown here, need not necessarily take up excessive space in the corner of a shop.

One type of portable instrument which will show caster, camber, and king pin inclination. Notice also the portable turning plate on which the wheel rests.

This instrument checks caster, camber and king pin inclination by means of light beams. It is attached to the rim by hardened steel claws which hook over the rim.

Alignment . . . CONTINUED

centerline of the king pin. Therefore, if the king pin is tilted backward the plane of the arc will be higher at the front than at the back. Therefore, if we measure the angle this circular plane makes with the horizontal, we have a measure of the caster angle.



Showing how excessive camber will affect tire wear. Both the inner portion and outer portion of the tire have to travel the same distance, but with the difference in the two radii the outer part will tend to go slower than the inner part, causing scuffing and excessive tire wear. This view is exaggerated to bring out the principle.

On late model cars of the different makes, this ranges from about 1½° positive to 1½° negative.

CAMBER

This is the angle the center plane of the front wheels make with the verticle. If the wheels lean outward slightly we have *positive* camber; if they lean inward, we have *negative* camber. If camber is not specified, positive camber is meant.

Purpose: To bring the center of the tire tread in contact with the road more nearly under point of load.

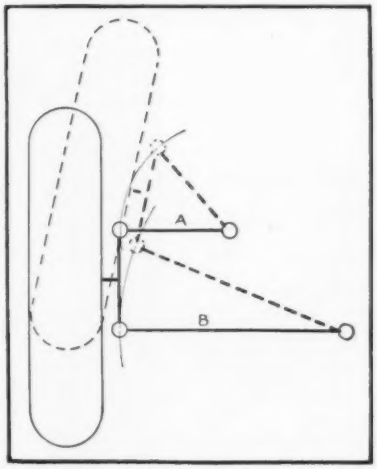
Measuring: Camber is measured either by measuring directly how much the wheel leans inward or outward, or by measuring the angle the steering spindle center line makes with the horizontal when the wheels are pointing straight ahead.

TOE-IN

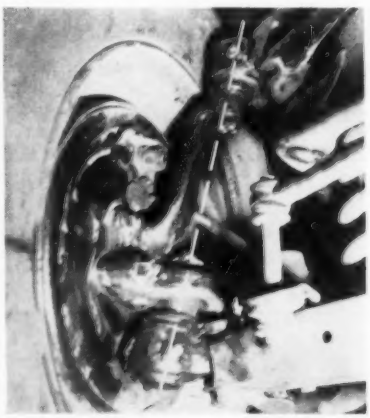
Toe-in means the wheels are pointing inward slightly, toward the front of the car. In other words, the distance from a certain point on the front of each front tire will be less (measured at spindle height) than the corresponding distance measured from the back of one front tire to the back of the other front tire.

Purpose: To prevent excessive tire wear and to insure proper steering on the straightaway.

Measuring: Toe-in is checked in various ways: (1) by using a tram and measuring front and back distances on the center of the tire treads; (2) using steering heads attached to turning plates; (3) using a light-beam portable wheel aligner that attaches to the wheel hub by powerful, permanent magnets; (4) using a gauge which expands by springs against the inner faces of the two front tires and indicates how parallel or unparallel they are; (5) running the front wheels over one of the toe-in checking machines which indicates toe-in or toe-out in feet per mile.



Showing how camber changes with wheel movement from road irregularities. It is essential that the bottom of the wheel move vertically to avoid changes in wheel-to-wheel distance on the road surface. This is accomplished by having the upper control arm (A) shorter than the lower control arm (B).



Photograph of the ball-joint wheel mounting. The dotted line is the center line which corresponds to the center line of the king pin.

KING PIN INCLINATION

This is the angle the king pins lean inward toward the center of the car (from about 3° to 7°). The angle of king pin incineration is a "built-in" factor and will be correct unless the related parts are bent.

Purpose: To reduce the need of excessive camber to put the center of the tire tread in contact with the road to provide easier steering and prevent excessive tire wear.

Measuring: An important point to remember in measuring or checking king pin inclination is that its direction of deviation from the verticle is at right angles from the direction of the caster angle and therefore the measuring scale or the bubble-glass level that measures king pin inclination will be at right angles to the one that measures caster.

TURNING RADIUS

Turning radius or steering geometry is the relationship between the front wheels on turns, controlled by the angle of the spindle steering arms.

Purpose: To allow front wheels to turn on a common center and thus prevent the inside wheel from dragging sideways.

Measuring: The steering arms, as made originally and installed on the car when new, have just the correct turning radius and this angle is not normally adjustable.

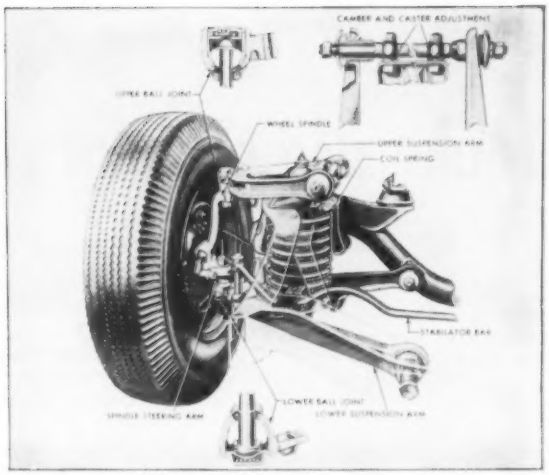
In addition to the above, there is a sixth factor in steering geometry (as pointed out by the Weaver Mfg. Co.), which is *Wheel lever arm.* This is the distance from the point where the extension of the center line of the king pin hits the road or floor surface, to the center of the tire print on the same surface.

Correct wheel lever arm can be measured only by checking king pin inclination on every job. When camber and king pin inclination are at factory specifications and are the same for both front wheels, the wheel lever arms will be equal. If the wheel lever

When it is necessary to replace worn ball joints, which is often required, a tool like this makes the operation of removing the old ones quite simple and quick.

arms are not equal, steering will be unsatisfactory because the wheel with the greater lever arm will have more tendency to turn outward, and cause the car to "lead" and produce road shock. Incorrect lever results from a bent steering spindle.

There is an interesting fact about camber which has been introduced into steering geometry with the almost general adoption of knee action front suspension and the use of upper and lower control arms with a coil spring at each front wheel. This is the fact that camber changes with every movement of the control arms. This is



Detail of knee action assembly with ball joint wheel mounting. Notice the difference in length of the upper and lower control arms, which maintains constant tread distance on the road surface.

necessary in order to maintain a constant trend distance where the tires contact the road surface in order to avoid side scuffing which would occur if the lengths of the two control arms were the same. Having the upper arm much shorter than the lower arm makes the top of the tire and wheel swing inward as the spring is compressed, but maintains a constant distance from tire to tire on the bottom. Thus, if the front springs should be sagged the camber will be changed. Camber should be measured with the car unloaded and with the springs at their normal length.

Now that we have seen what has to be checked, and corrected when necessary, let's look into the matter of the equipment that is available for this work, emphasizing the possibilities of doing the work efficiently and profitably in limited space.

About the best installation, and one which does not take up much space, is the front end pit. Such a pit only needs to be from 24″ to 30″ deep, and need not take up more than an area 4′x6′ to 6′x8′. However, if space does not permit such a front end pit, it is still perfectly practicable to do the work by selecting a level space on the shop floor, using portable turning plates for the front wheels. If this is done, boards or steel plates of the same total thickness as the turning plates should be used under the back wheels to keep the car level. Also, by running the four wheels up on small ramps, blocks or frames to raise the car about 6″, it is possible for the operator to get under the car on a creeper to adjust toe-in, camber and caster.

Caster, camber and king pin inclination can readily be checked with portable instruments attached to or held in alignment with the wheel, hub or steering spindle. The instruments are simple and quick to use, providing

(Continued on page 47)

Another type of portable instrument which attaches to the wheel hub to show caster, camber and king pin inclination.

This easy-to-use portable instrument is attached to the wheel at three points by permanent magnets.

By FRANK E. LEE

Make use of color in your shop

The selection of the correct tints and shades, both from a functional and attractiveness standpoint, creates a dynamic, powerful production and selling medium in all businesses where automotive service is done

• COLOR CAN BRING MORE BUSINESS into the automotive service shop.

Color can increase shop profits.

Color can improve shop working conditions.

Yes, this sounds like big talk—but these are only a few of the important benefits that color can bring to the automotive service shop.

With all of these benefits to gain, let's dig into this thing called color and see why this is so. Let's see why it's a good idea for any automotive service shop to take advantage of color.

Some years ago, and even today in many places, the only reason for painting a shop interior was to keep the wood from rotting away or to protect the putty on the windows.

SURFACE PROTECTION SECONDARY

Today emphasis is placed on use of the right color in the right place in the shop. The protection of the surface under the color is of secondary importance. This doesn't mean that any paint will do the job because, to be effective, a finish must have a certain degree of permanence. However, both problems can be answered by selecting the proper color in a finish prepared for the surface and for the purpose.

A few moments reflection on the use of color in the automotive shop brings up several pertinent questions.

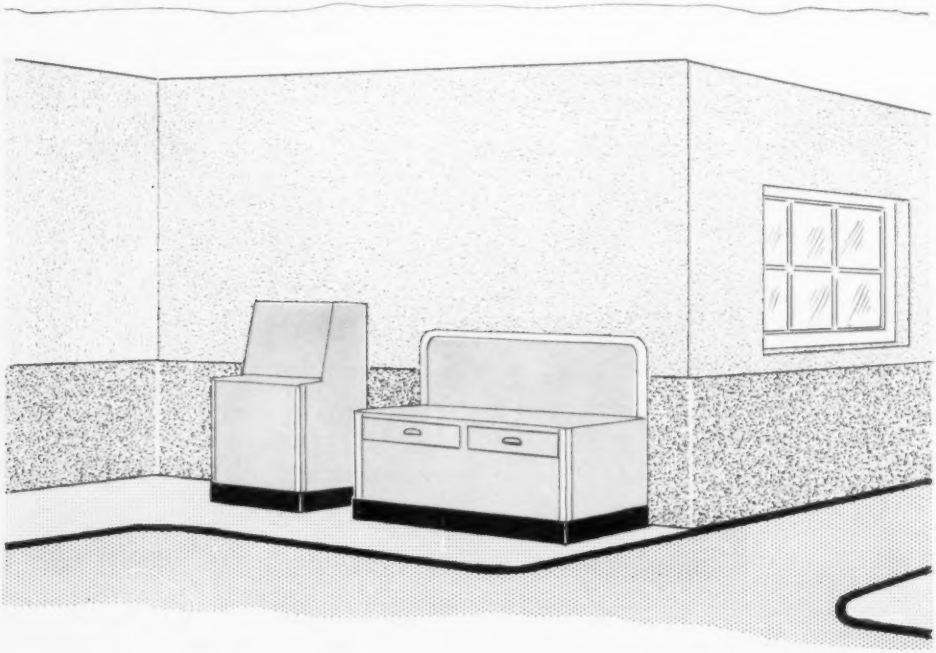
- Why use color in the shop?
- What color or colors should be used?
- Why not use any color—one probably is as good as another?

WHY PAINT THE SHOP AT ALL?

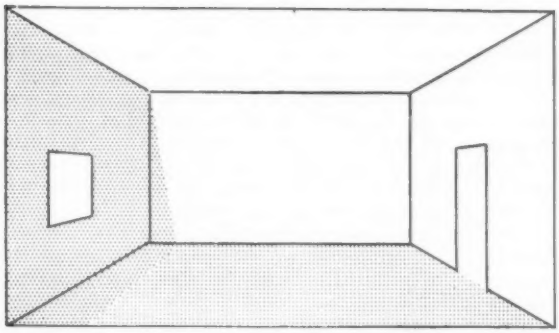
To take the last question first—on some jobs mechanics may have to work with dirty, greasy parts. They are apt to get their hands, clothes, the shop floor, and maybe even the walls, dirty. Under these conditions it is easy to develop an attitude of why clean up the shop today—it will just get dirty tomorrow.

But does the shop that got dirty yesterday have to be dirty today and stay dirty tomorrow and, from then on, remain just a dingy, unattractive place to visit and a still more uninviting place in which to work?

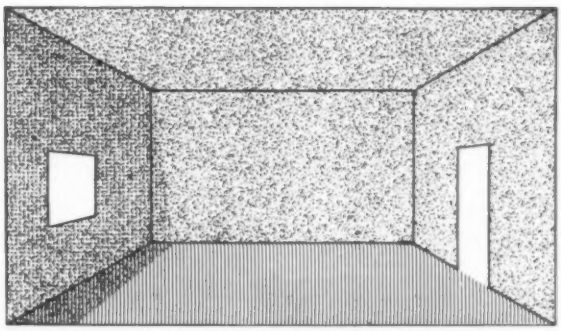
Some years ago, when the general appearance of one



Shaded areas of varying tone values simulate actual colors. For example, the major color surfaces could be white ceiling, ivory wall, brown dado, light gray or medium red floor, medium red equipment, yellow zone mark. Other practical combinations are possible to fit specific conditions.



Colors on the light side have the effect of making a room look larger and more cheerful, especially if colors with high reflection values are used which provide even distribution of light.



Here the same room as in left hand illustration looks smaller and more cramped because of the darker colors. The distant wall looks closer, but it's the same as the illustration at left.

store or shop was little different from that of other stores and shops, there probably was little incentive for the automotive shop to look any different than a blacksmith or sheet metal shop. Those were the days when the man of the house looked after such things as landscaping the homesite, cutting the grass, and keeping up the family automobile.

Today, it's different. The lady of the house has practically taken over management of the yard and the family car. This may seem like a simple realignment of family responsibilities, but, from the viewpoint of the automotive shop, it represents a drastic change in how customers react to the general appearance of the shop.

Today, in a sense, the automotive shop is in direct competition with every other store in town, even though the shop may be the only automotive shop in that town or in the neighborhood.

On one shopping trip a woman may visit a modern new supermarket, an immaculate drug store, an inviting new hardware and appliance store, the striking new department store in the spacious shopping center, and an automotive service shop.

PEOPLE REACT TO THEIR SURROUNDINGS

People unconsciously react to their surroundings, especially true of women. People are always forming opinions whether they are aware of it or not.

- A supermarket looks trim and neat—that must be a good place to buy food.
- A drug store has an attractive, inviting look—the pharmacist must be a careful person who will fill prescriptions accurately.
- An automotive shop is clean, orderly, and has a pleasant look about it—that's the place to have the brakes relined, the engine tuned, or a fender straightened and repainted.

Suppose the shop is dirty, littered, and unattractive—an unkempt atmosphere prevails, though the shop is on the main street in town. It's a good bet that the appearance of the shop will drive customers away, especially the women, although men are not blind either and they, like the women, will react favorably to a shop in which the functional benefits of color are used to the fullest.

Perhaps equally important to presenting a shop appearance that attracts customers is the creation of a shop atmosphere that establishes the most favorable working conditions. Working conditions play a very important part in the production of good work and in holding the turnover of shop labor to a minimum.

The use and selection of colors for automotive establishments should not be considered in the same light as color selection for the home. Some of the more important objectives in the use of color in the shop are:

- Create additional visibility. This helps men do better work.
- Relieve eye strain.
- Serve the practical needs of the shop.
- Improve safety of the shop.

At the outset it should be understood that the functional purposes in selecting a color, or combination of colors, should always take precedence over appearance considerations. If this distinction is always kept foremost in mind, the end result generally will be a combination of colors that has an overall attractive appearance because it is well suited to the functional demands of a particular shop.

Colors used for interior decoration of the home generally are not suitable for the shop. They may be too bright, too delicate or too clean, to be practical in the shop. Colors used in the shop should be grayish in tone, unobtrusive, and proved by science to be practical. Colors in this group tend to establish a comfortable brightness ratio within the field of vision. In achieving this purpose shop colors actually help the mechanic in seeing the job

(Continued on following page)

WHAT MAKES COLOR A COLOR?

- Any discussion of color is, perhaps, not complete unless a word is said about how people react to color. The truth of the matter is that a color is not a color until it is struck by a light and various wave lengths of the light are reflected back to a human eye.

- Even though the workings of color vision still is a mystery, scientists have learned what kind and how much color can be seen. Surfaces reflect varying proportions of the wave lengths that exist in a light. The wave lengths that are not reflected are absorbed by the color. Therefore, colors are related to the length of the waves of light that a surface reflects.

- When the color properties of a surface are such that medium length waves are reflected and most of the short and long waves are absorbed, the net result is a color known as green. If the long waves are reflected and the medium and short waves are absorbed, the color is red. The color yellow results if the long and medium waves are reflected and the short waves are absorbed. Blue is seen when the short waves are reflected and the medium and long waves are absorbed. If all waves are reflected in equal proportions the color is white, and when all waves are absorbed the color is black.

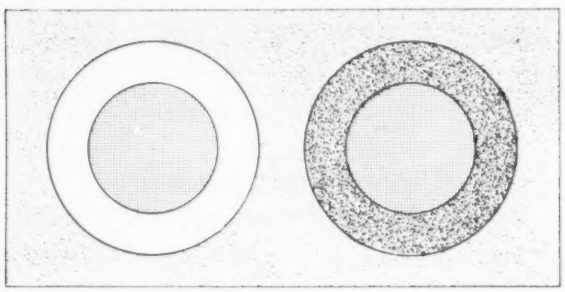
Color in the Shop . . . CONTINUED

he is doing. Finally, colors for the shop should be capable of withstanding soiling and abuse.

Color is useful only to the extent that it benefits people. In the shop the people to consider mainly are the mechanics. If the colors used on various surfaces do a good job for the mechanics, the shop will also be attractive.

WHAT COLOR CAN DO

Scientifically speaking, light is a form of energy. Thus,



A relatively bright color, gray (area in inner circles) appears dull against a yellow background (white circle) but brighter against a blue background (dark circle). Note that the gray color (inner circles) is identical in tone value in each case.

color can also be considered as a form of energy. Since the energy in color is in continual action on the eye and brain, the result may cause many unusual effects on human behavior. For example, consider some of the effects that can be created by color:

- Color can create an atmosphere of comfort and well-being; it can inspire and stimulate; and it can also irritate, fatigue, and depress.
- Color can change the appearance of size and distance of objects; it can change the apparent weight of an object; it can aid people to see objects more distinctly and it can also make objects less distinct.
- Color can change the apparent size of a room; it can make a room feel warmer and it also can make a room feel cooler.

When all of the possible effects that can be created by color are considered, it becomes readily apparent that it is worthwhile to use color to its fullest advantage. This fact gathers increasing impact when a person analyzes some of the human reactions that can be traced directly to color.

When a mechanic is working at a valve grinding machine, for example, and the color of the machine background is too much like the color of the valve, he is subjected to eyestrain. When the eyes become fatigued, reaction to this fatigue generally is not felt within the eye itself. Instead, it is carried to the nerves and muscles in other parts of the body. A person suffering from eye fatigue develops a tired, listless feeling. His mental attitude suffers. His alertness is dulled. He may become subject to nervousness, headache, stomach upset, and similar physical and mental disturbances.

Moving away from the immediate background established by the machine on which a job is in progress, the mechanic's eyes are rested each time he glances up from his work. That is, they are rested if the wall surfaces have a color compatible with the color of the working area of vision. If the surroundings are too dark or too light the eyes must readjust to the different light intensity each time they move from the job and back again.

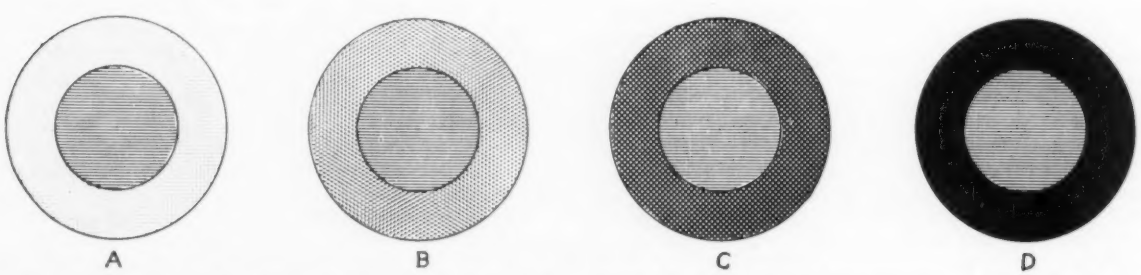
INFLUENCE OF WALL COLORS

A similar condition can be created by the color of the walls directly in front of the shop machines or work benches which are constantly within the mechanic's field of vision. The worker is always under the influence of these areas. He may be shifting his eyes for a moment of rest or he may be directing his vision to another portion of the engine or part upon which he is working. If the machine upon which he is working is dark and the wall color is light, or vice versa, his eyes have to adjust quickly each time a larger or smaller section of the wall comes into his field of vision. The physical effort required for a single adjustment is very small indeed. However, multiply this small effort by the thousands of times that an adjustment must be made during a day and the result is a very common source of eye and general body fatigue.

The answer is to paint the walls in restful colors to eliminate the need of the eyes to make continual fatiguing adjustments. The color of the wall does not necessarily have to be the same general color which the mechanic sees when he is concentrating on his job. However, it should have the same basic reflective value.

PHYSIOLOGICAL EFFECT ON THE MIND

Perhaps of equal importance to the effect color has on the eye and body is the physiological effect that color has on the mind. As a general rule, most people have a better outlook on conditions around them on sunny days than on days when it is raining or the skies are overcast. With this thought in mind it is a good idea to use colors inside the shop that suggest the bright outdoors and cheerful sunlight. As an example, many shops have high ceilings filled with beams, braces, pipes, heating ducts, and wiring that give a visual effect of disorder no matter how important the individual items. Through the proper use of color the unsightly distracting ceilings can be made to



If we paint the areas of four circles the same tone of medium green and border the one at A with a red tint, the green looks darker; B, with stratosphere gray, the green becomes lighter; C, with forest green, the green becomes still lighter. With a deep purple, D, around it the green appears very much lighter. The gray screen used in the middle circles of this illustration is identically the same.

recede into a composite background and give the shop an appearance of greater spaciousness.

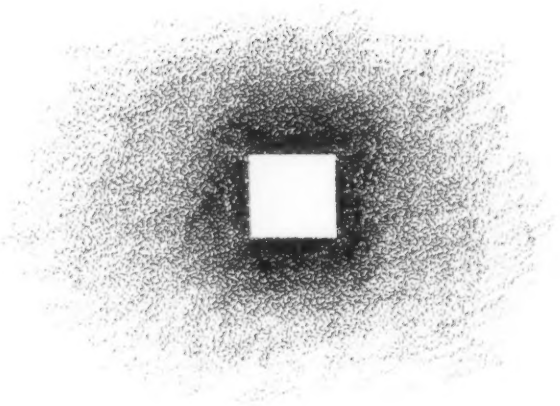
Strong light, whether natural or artificial, focussed directly on a working area can create a glare condition that is distracting and a nuisance to the mechanic. As a rule, the control of glare lies in the proper selection of the surface sheen of colors used on the various shop walls and machines and upon the selection and placement of correct lighting equipment. (*Editor's Note: An article by Mr. Lee on shop lighting will appear in a coming issue of* AUTOMOTIVE SERVICE DIGEST.)

COLOR SELECTION OBJECTIVES

Shop colors should create a general environment that is passive, rather than one that is impulsive. To accomplish this end the colors used in the shop should direct the mechanic's interest toward his job rather than away from it.

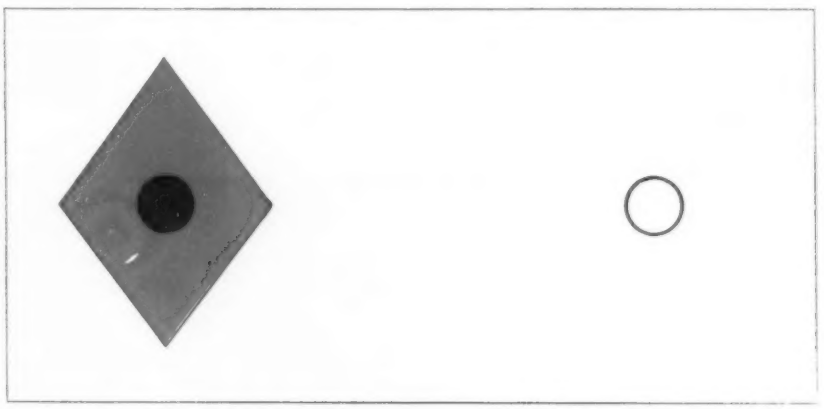
To achieve this goal, color in the shop must become an integral part of the mechanic's seeing effort. Color can be a silent partner on every job, helping every mechanic instead of standing around on the sidelines adding nothing tangible to the shop atmosphere.

Properly selected colors provide more comfortable seeing conditions by balancing reflection values on the various wall surfaces. A higher level of artificial illumination can be maintained without annoying glare because, when color is skillfully handled, areas of distracting brightness are eliminated. The improvement in illumination, gained largely through the proper use of color, can be a major factor in the increased productivity of the shop.



The dark shading around the white square emphasizes it so much that the white within the square actually appears lighter in color than that of this paper. Dark colors placed next to lighter ones always make the latter look still lighter.

Stare intently at the black dot in the red diamond for about 20 seconds. Then look quickly and stare at the circle to the right. An after image in the shape of a diamond will be formed. This is complementation. Complementary colors emphasize perception—the ability to see and recognize objects.



Another objective gained through the use of color is the improvement in the general health and morale of all who work in the shop. A shop that is light, bright, and cheerful gives the mechanics a reason for having more pride in the place they work and more self-respect.

If shop colors create a restful atmosphere, nervous tension is reduced. However, if colors are selected merely because they seem striking or attractive, or because they look well in someone's home, employees may be forced to work in surroundings that are psychologically unsuited to them and the work in which they are engaged.

COLOR SELECTION

Color energy should be treated as a source of power. This power can either stimulate or depress. Thus, the selection of color should be made with the mind as well as the eye.

There are certain problems to be solved in the selection of color for the automotive shop. The solution of these problems can be based on measurable things and not on intangible desires. This is merely another way of saying there are right and wrong colors for all surfaces in the shop.

Paint manufacturers have done an admirable job in showing how the selection of shop colors can be based on a sound process of principles. These principles have been developed to achieve a purpose and have been proven in actual use. Because of this research, trial and error methods have been practically eliminated. As a result, the shop can anticipate a greater return on every dollar invested in maintenance painting.

Primarily colors are selected on the basis of how they affect the mechanic's ability to see. The functional application of color used with proper lighting improves seeing conditions considerably more than does an increase in the footcandle output of the lighting alone.

Certain colors—red, yellow, and ivory—are looked upon as being in the warm range of color. These colors are closely associated with the warmth of sunlight and will make a large, chilly shop seem friendly, warm and inviting. Green and blue have the psychological effect of being cool and relaxing.

(Continued on following page)

Color in the Shop . . . CONTINUED

Some of the tangible facts upon which the scientific selection of color is based are as follows:

- **Visibility:**—An extreme contrast in light and dark value heightens visibility. The best contrast is provided by using black on yellow. However, to create the best seeing conditions, contrasts should be restricted to the working field of vision. Sharp contrasts elsewhere in the field of vision should be avoided, except as required for reasons of safety.

- **Preference:**—Studies of a number of psychologists, considered on the whole, indicate that men prefer blue and women prefer red. There are many shades and tints in the blue color spectrum that are psychologically correct for the automotive service shop.

- **Warm Colors:**—Warm colors are predominantly red or yellow. They make cool, vaulty areas seem warm and friendly.

- **Cool Colors:**—Cool colors are mostly blue and green. These colors make hot or exciting areas seem cooler and more restful.

- **Simultaneous Contrast:**—The apparent value of any color is affected, to a large extent, by background colors. A relatively bright color such as gray, against a yellow background will appear rather dull when compared with the apparent brightness of the same gray hue against a blue background. Because of this, simultaneous contrasts should be avoided in background colors.

- **Irradiation:**—Irradiation is the apparent enlargement of a bright object as seen against a dark background. This effect is caused by the stimulation of the bright object on the portions of the retina of the eye that serve to frame the image against the dark background. Irradiation can be used in the automotive shop to emphasize danger areas on moving parts of shop equipment.

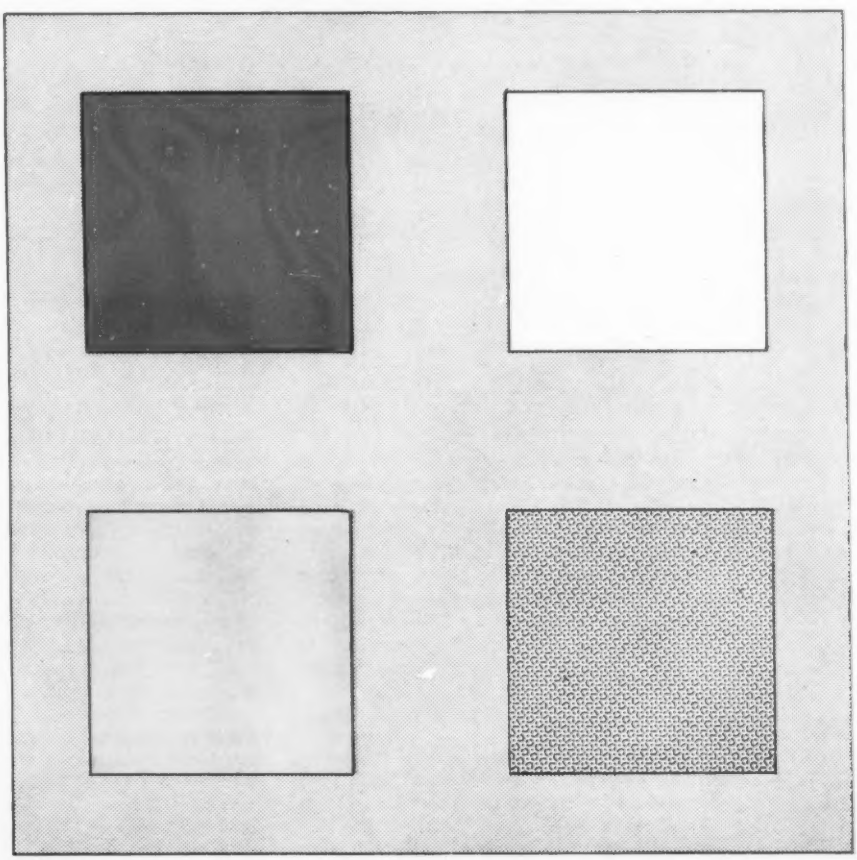
- **Stimulation:**—Properly selected colors have a wholesome stimulating effect on persons who work in or enter a particular room. Some stimulation through the use of color is good. However, a shop or a machine done up gaudily in a riot of color will undermine any possible benefits of stimulation. The net result of overdoing the use of color will be to set up unnecessary visual competition for the mechanic or any one who may enter the shop.

- **Complementation:**—Colors which are complementary emphasize perception or the ability to see and recognize an object.

A simple experiment to aid in the understanding of complementation is to stare intently at a small colored design, such as a circle, square, or triangle, on a white background—for about twenty seconds. Then shift the eyes immediately and look intently at a small black dot on a piece of plain white paper. An after-image, shaped like the original design, will be formed on the paper. The color of the after-image will be the complementary color of the color used on the original design. Typical examples of complementation are: pink complements green; gray blue complements yellow; and yellow complements blue.

- **Distraction:**—Bright colors placed in the line of

(*Continued on page* 76)



Harsh color contrasts close together make objects much harder to see. The top squares (harsh contrast) are not as readily visible as the two lower squares where colors of about the same color value are used.

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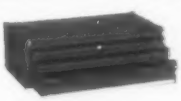

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By GUY F. WETZEL
Technical Editor

Trouble shooting the ignition system

There is nothing mysterious or unusually difficult about this work when mechanics follow a given line of procedure, acquire the necessary knowledge, and understand the specific instructions supplied by the various makers of test equipment.

● TROUBLE SHOOTING might be defined as mentally picturing the system of the automotive power plant that is at fault, then thinking of all the things that could go wrong, and eliminating these one by one.

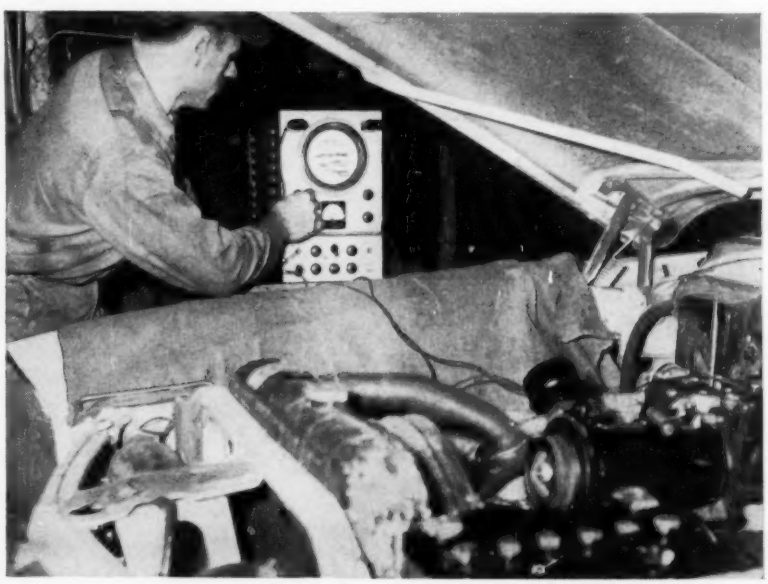
Going back a little bit further, however, we first have to allocate the trouble to the system at fault. In some cases this is not too easy to do. For example, we have seen instances where a worn rubbing block on the distributor breaker arm reduced the dwell and breaker point opening so much that the points were barely opening, and the engine stopped. The symptoms were much like those of a defective fuel system, and that is what was assumed to be the source of the trouble. Under such conditions, each system—fuel and ignition—would have to be considered, to eliminate either one as the source of the trouble.

Therefore it is obvious that in trouble shooting, a detailed knowledge of the system that is suspected is necessary. This requires understanding of each of the units involved in the system, their relation to each other, and how each one functions.

In the ignition system, starting with the source of current, in the primary or low tension circuit, a wire goes to the ammeter, if one is used, to the ignition switch, to the resistor (used on 12-volt systems only), to coil, to the distributor, and through the distributor breaker points to ground, with a condenser in parallel with the breaker points.

In the secondary or high tension circuit (HT circuit), starting at the coil tower, the conductor goes to the center tower on the distributor cap, where contact is made with a metal insert which in turn contacts the center of the distributor rotor. Through a metal conductor on the rotor, the HT current is forced to jump a gap from the end of the rotor to each of the 6 or 8 metal insert contacts, in turn, equally spaced around the inside of the distributor cap. From each of the distributor cap contacts, in turn, in the same order as the firing order, the sparking current impulse is sent by means of the spark plug conductors, to the spark plugs.

The main components of the ignition system are coil,



The automotive oscilloscope is the ideal instrument for quickly diagnosing trouble in the ignition system.

distributor, and spark plugs. A review of their functions will be of help in understanding symptoms of trouble that may arise and require correction.

THE COIL:

The function of the coil is purely electrical. Its job is to transform the low voltage supplied by the battery into the high voltage electrical energy necessary to jump the spark gap in each spark plug.

The high tension voltage will vary considerably, depending on the compression pressure; since the resistance offered by the spark gap in each plug is about proportional to this pressure. This means that the coil voltage will rise to the point it has to reach in order for the spark to jump the gap, and will range from around 3,000 volts to as much as 20,000 volts, or even higher on today's high compression ratio engines.

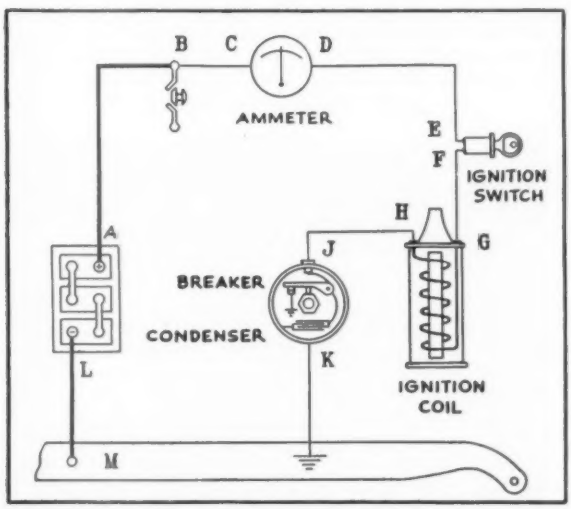


Diagram showing the primary circuit of a 6-volt ignition system. A 12-volt system would be just the same except that a resistor is ordinarily used between F and G, though it can be located between H and J. Each lettered point is a place where there could be high resistance.

Each unit in the high tension system must have sufficient capacity to withstand the high voltage. This will explain why engines sometimes run satisfactorily at light load but plugs will misfire at higher loads and speeds. If any units in the circuit are not in condition to handle the high electrical pressure, the current to the plugs will not fire them dependably and engine performance will not be satisfactory.

An ignition coil has two windings, wound on a soft iron core: the primary winding, consisting of comparatively few turns of heavy wire; and the secondary winding, consisting of many turns of very fine wire. The primary winding is usually wound around the outside of the secondary winding. A soft iron shell encloses the outside of both windings and serves to complete the magnetic circuit.

When the distributor contacts or breaker points are closed, a primary current flows from the battery to the coil primary, to the distributor points, to ground. The current flowing in the primary winding produces a magnetic field in the coil core and case. When the breaker points open, the current stops flowing and causes the magnetic field to collapse very rapidly. This collapsing field causes the magnetic lines of force to cut the windings and induce a voltage in the secondary that is sufficient to spark at the plug electrodes. This same collapse of the magnetic field induces a voltage in the primary which may get as high as 250 volts. This energy charges the condenser, and the condenser also absorbs the energy that would otherwise cause sparking at the breaker points, speeding up the collapse of the coil magnetic field. As the spark is extinguished, the energy stored in the condenser and coil is discharged.

Proper operation of the distributor is essential for satisfactory functioning of the ignition system. The only way this unit can be checked accurately is on a distributor tester which can test both automatic advance and vacuum advance, as well as the firing pattern.

COIL TROUBLES

In general the coil is a pretty dependable piece of equipment, with no moving parts or mechanical motion. But sometimes turns in one of the windings get shorted, or the insulation between layers of wire breaks down, or internal connections become loose. The result is a coil that does not work at all, one that works intermittently, or one that may work when cold and fail to work when hot. Another possible source of trouble is the connection at the coil tower. If the HT wire is not pushed all the way down into the metal socket, there may be a poor connection which will cause high resistance and a weak spark to the distributor. Loose primary wire connections can

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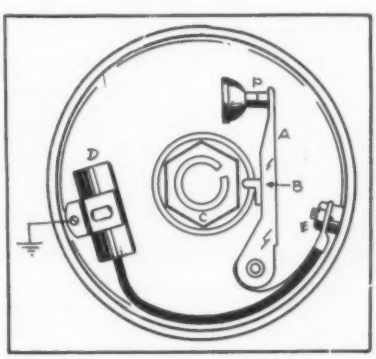
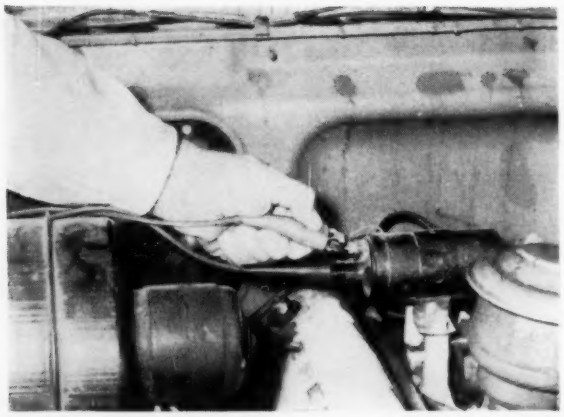


Plan of a six cylinder distributor. The letters P, A, B, D, and E indicate possible trouble spots. In addition there is a pigtail from the breaker plate to ground on some distributors.



Checking the voltage drop across the coil. By connecting the black terminal to ground (on positive ground systems) the voltage to the coil can be obtained. This, compared to voltage across the battery will give the voltage drop in the primary up to the coil, on 6-volt systems. With 12-volt systems, the terminal will go to the battery side of the resistor to get the primary voltage drop.

Trouble Shooting . . . CONTINUED

also cause high resistance and a weak primary current with resulting weak spark.

If there is any reason to suspect the coil, it should be tested on a reliable coil tester. In the absence of a coil tester, substitute a coil that is known to be good. The test made by opening the points by hand and seeing if a spark will jump is *Not* a dependable test and should not be relied upon.

It is quite important that coil polarity be negative in the high tension circuit. This is checked by connecting a high voltage voltmeter with its negative terminal connected to or touched to a spark plug and with the positive terminal grounded. If the meter reads up scale, with the engine running, the polarity is correct. Whether the primary circuit has the negative or positive side grounded, the secondary or HT circuit should have negative polarity.

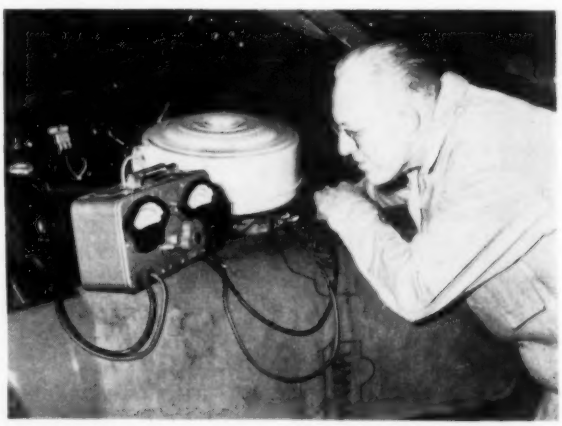
THE DISTRIBUTOR

The distributor is the only unit in the ignition system that has mechanical motion, and it has three jobs to perform. First, it opens and closes the low tension circuit between the ignition coil and ground so that the primary winding is supplied with intermittent surges of current. Each surge of current builds up a magnetic field in the coil. The distributor then opens its circuit so that the magnetic field will quickly collapse and cause the coil to produce a high voltage surge in the secondary circuit.

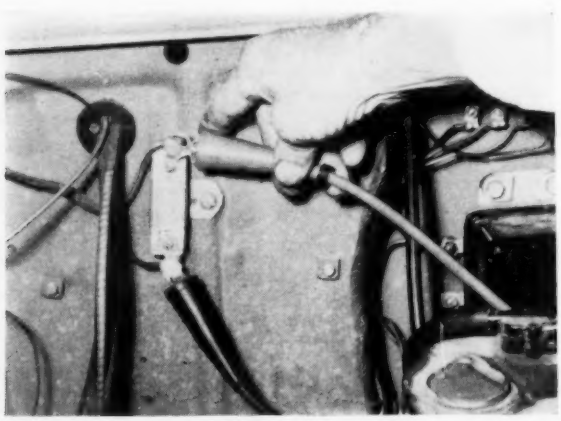
The second job of the distributor is to accurately time these surges with regard to engine requirements, considering speed and load. This is accomplished by the centrifugal (automatic) and vacuum advance mechanisms.

The third duty of the distributor is to direct each high voltage surge through the distributor cap, rotor, and high tension wiring to the spark plug which happens to have its piston and valves in firing position.

To perform these jobs requires that there be two separate circuits in the ignition distributor. One of these is the primary circuit, which includes the contact or breaker points, the pigtail from distributor external terminal to the movable point, and the condenser. The other is the secondary or high tension circuit, which includes the distributor cap and rotor.



Checking the voltage drop in the ignition circuit. Loose or corroded contacts can cause plenty of trouble and can keep an engine from running. Don't overlook the ground circuit and the importance of having a good ground from the frame to the engine.



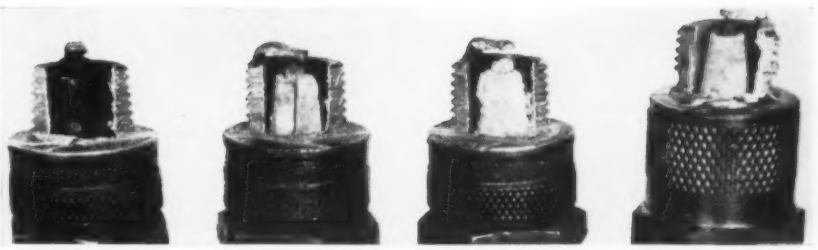
Checking the voltage drop across the ignition system resistor on a 12-volt system. The voltmeter leads connected from the battery side of the resistor to ground will give the voltage available for ignition purposes.

DISTRIBUTOR TROUBLES

The distributor performs both mechanical and electrical functions, and therefore will be subject to both kinds of trouble. Distributors in general are marvelous pieces of mechanism, performing with a high degree of accuracy for long periods and many thousands of miles, but wear does take place and there are electrical failures now and then.

As time goes on there will be normal wear on the moving parts, such as wear on the distributor shaft bearing and wear on the breaker cam on the distributor shaft. This will allow looseness of the shaft in the bearing and of the breaker cam, which, if it exceeds a certain limit will cause varying cam or dwell angles and irregular action of the breaker cam. If the cam wears unevenly, the firing pattern will not be regular and may affect engine operation.

The proper way to check a distributor is to put it on a distributor tester and test it against factory specifications; also checking the firing pattern, which will, in turn, test the accuracy of the breaker cam. The dwell angle can also be readily checked and adjusted if necessary.



Four spark plugs which show the importance of careful inspection and analysis of them. Left to right: plug badly carboned, shorting out its cylinder; split ceramic insulator nose, which causes misfiring; excessive deposits on the insulator nose which will cause misfiring at high speeds or heavy loads; and normal plug of the correct heat range.

The breaker points usually are the shortest lived parts in the distributor. They are subject to uneven wear due to misalignment, burning from excessive voltage regulator setting, or from oil in the distributor, mechanical wear, electrical erosion, and displacement of metal because of wrong condenser capacity. Wrong primary polarity will also cause rapid deterioration of the points.

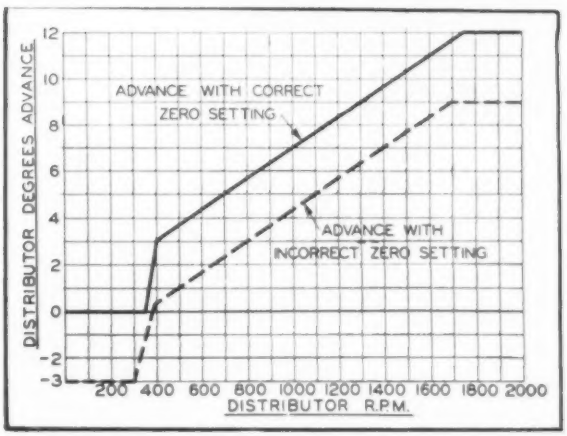
NEW POINTS NOT A "CURE-ALL"

When points need replacing because of burning, excessively rapid wear, or misalignment, new points will be subject to the same troubles unless these troubles are corrected. Therefore, a careful trouble shooter will always examine the points very carefully to see what information he can get from them. If new points are needed, they should always be put in before adjusting the dwell or checking the firing pattern on the distributorscope.

In the absence of a distributor tester, a quick check of the automatic advance can be made by holding the distributor shaft and turning the cam by moving the rotor in the direction of distributor shaft rotation as far as it will go, and then releasing it. The cam should return to its original position with no drag or restriction. If the governor action is sluggish the distributor should be overhauled or replaced.

The mechanical operation of the vacuum advance can be checked in a similar manner. Move the breaker plate against the direction of distributor shaft rotation and release it. The breaker plate should freely return to its original position without drag or hesitation. If it is not free the advance mechanism should be checked. These tests will not indicate whether the automatic advance and vacuum advance are in accordance with factory specifications, as these can only be tested with suitable equipment.

Occasionally the distributor cap will be blown off by an explosion in the distributor. This is caused by a leaking diaphragm in the vacuum advance device at the side of the distributor. Gasoline from the carburetor works through the leak into the distributor, and when the mixture happens to be just right, it is ignited by a spark at the breaker points and explodes, usually blowing off the distributor cap. The vacuum advance will not work with a leaking diaphragm so that performance and efficiency suffer. To correct this trouble put on a new vacuum advance unit.



A typical distributor advance curve. The solid line shows the advance with the correct zero setting, while the dotted line shows how much off the action will be if the initial spark timing is incorrect.

The rubbing block on the breaker arm is made of vulcanized fiber or a similar material, and will gradually wear down with use, though the rate of wear is very slow. As the rubbing block wears the breaker point gap will get smaller, but this is offset to some degree by corresponding wear on the points. However, if the wear on the rubbing block is faster than the wear on the points, the point gap when fully opened will decrease. This also changes ignition timing, as a smaller gap retards the time the spark occurs. Therefore, checking the dwell is quite important when shooting trouble, as decreased dwell angle tells at once that the point gap is not right.

Another source of trouble, though this does not occur very often, is the breaker plate. If the plate bearing becomes worn, the plate may cause variations in the firing time of the individual plugs. The plate is usually grounded to the distributor housing by a pigtail. If this pigtail should have loose connections or be missing, there may not be a good ground from the fixed breaker point, which could result in possible ignition trouble. This should be kept in mind as it can easily be overlooked.

The condenser is not part of the distributor, but it is usually located in the distributor. The condenser can fail by being open (broken internal connection), by insulation break-down, internal short, or internal ground. In some cases there is high resistance in the condenser caused by loose condenser mountings, loose lead connections, or poor connections inside the condenser. Actually

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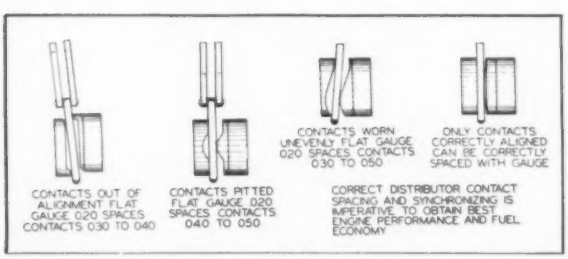
CONTACTS OUT OF ALIGNMENT FLAT GAUGE .020 SPACES CONTACTS .030 TO .040
CONTACTS PITTED FLAT GAUGE .020 SPACES CONTACTS .040 TO .050
CONTACTS WORN UNEVENLY FLAT GAUGE .020 SPACES CONTACTS .030 TO .050
ONLY CONTACTS CORRECTLY ALIGNED CAN BE CORRECTLY SPACED WITH GAUGE
CORRECT DISTRIBUTOR CONTACT SPACING AND SYNCHRONIZING IS IMPERATIVE TO OBTAIN BEST ENGINE PERFORMANCE AND FUEL ECONOMY

When points are worn, it is impossible to get an accurate gap reading with a feeler gauge (except on brand new points). The recommended procedure is to use a dwell meter.

The use of 10-power magnifying glass will give some interesting information about spark plugs, particularly the electrodes. Here the mechanic is carefully examining a set of plugs.

Plugs which are in good enough condition to give further service, as well as new plugs, should be gapped according to specifications. A tool such as this does the gapping accurately and quickly.

Trouble Shooting . . . CONTINUED

the condenser is about as trouble free as any component in the ignition system, but it must not be overlooked as a possible source of trouble.

The distributor cap is subjected to voltages which, on the late model high compression ratio cars, may run in excess of 20,000 volts. Thus, if there is even a suggestion of a crack or defect in the molding of the cap, there may be leakage which will ground out one or more cylinders or cause cross firing. In some cases a defective cap can be spotted by a visible spark, by the sound of a spark jumping, or by close inspection. It pays to have a magnifying glass available for inspecting distributor caps, rotors and spark plugs, and to carefully examine distributor caps for cracks, scratches or defects. If in doubt, put on a new cap.

The distributor rotor is made of material similar to the cap and is subject to the same voltages. Any cracks or defects in the material will allow the spark to jump to the grounded distributor shaft, which will, of course, prevent firing at the plugs. Cases have been called to our attention where a spark will jump from the rotor to the pigtail that connects to the points, if this happens to stick up toward the rotor. In this case one or two cylinders would be caused to misfire consistently. It sometimes occurs that rotors which have been in use for some time will suddenly fail and interfere with the ignition, so this should be kept in mind as a possibility.

SPARK PLUG TROUBLES

The most important point about spark plugs is that the days of getting 10,000 miles or more on a set of plugs are gone, as far as the later model cars are concerned. Some important improvements have been made in spark plugs but they still appear to be the weakest link in the ignition system chain. High compression ratios—8.5 to 1 and up to 10.5 to 1—put severe loads on plugs and they do not hold up like the plugs did when compression ratios were 6 to 1 or even 7 to 1. Therefore, plugs should be suspected when trouble develops in the ignition system, unless it is quite obvious that the plugs are not at fault.

Spark plug installation is very important. They should be torqued in place with a new gasket using about 28 ft. lb. for 14 mm plugs or 15 ft. lb. with the 18 mm plugs without gaskets used on Ford-built engines. Plugs not tightened properly, which is very common, will become overheated, especially on long trips or high speed driving, and will have their service life materially shortened.

Another trouble is from deposits on the ceramic insulator due to many cold starts and short runs, which is such a common driving condition, particularly in the cities. Such deposits will cause misfiring on rapid acceleration or when the engine is put under heavy load.

Plugs which have been in use quite a while will have the center electrode rounded on the end. Such a rounded end will require as much as 30% or more increase in high tension voltage in order to fire as compared with a new plug with a square end on the center electrode. As the center electrode becomes rounded the ground electrode also becomes worn, with the result that the gap increases materially. Wide gaps require higher voltage to fire them, so that unless the available voltage is at least equal to the required voltage, the plug will misfire under acceleration, heavy load or high speed.

The heat range of the plug is also important, since if a plug is too hot it will have a shortened service life and may cause preignition; if it is too cold, excessive deposits will form on the ceramic insulator which will short it out under certain conditions.

The troubles which may affect spark plugs are: Broken insulator top due to rough handling, split insulator nose, side electrode excessively worn, with oversize gap, plugs burned due to wrong heat range, and excessive deposits due to too cold a plug.

While cleaning and gapping used to be the normal procedure, it is better to put in new plugs on today's high compression engines, if there is any doubt about the operation of the plugs, regardless of the mileage on them.

IGNITION SYSTEM WIRING

One of the first places to look for trouble when the ignition system is not functioning as it should, is the wiring. Each wire offers three possible trouble spots—two ends, and the conductor between the ends. The ends have terminals for making contacts, and if the terminals are not tight on the ends of the wire, or the terminals do not make good contact with the connectors, binding posts, or screws, there will be high resistance points in the circuit. There is always the possibility of a broken conductor due to vibration, defective manufacture, corrosion or mechanical breakage. If any circuit appears to be open and the terminals are tight run a jumper wire around the suspected wire, and if this completes the circuit, it shows that the original wire is defective and should be replaced.

The high tension wires or conductors may have loose terminals or the terminals may not be pushed all the way into the receptacles in the coil tower, or in the towers on the distributor cap. Making a spark jump at these points causes corrosion (high resistance) and can seriously interfere with the ignition spark. These wires are also subject to deterioration of their insulation due to heat, age, oil, and the corona effect of the high tension

voltage. This may permit cross firing where the wires are close together or in a metal conduit, so the trouble shooter should always examine these conductors carefully and recommend new ones if they are in poor condition.

On 12-volt ignition systems it is customary to insert a resistor in the primary circuit between the ignition switch and the coil. This resistor is designed to reduce the voltage to the coil to about what it would be with the cranking motor in operation. An additional wire to the coil by-passes the resistor while the cranking motor is in operation, so that even though the battery voltage is lowered temporarily because of the cranking motor load, the ignition system gets its full voltage, which makes starting easier.

The use of the resistor introduces another unit which could cause trouble, and in addition two extra connection points plus the extra circuit from the starting motor relay. Occasionally the resistor will burn out, or the by-pass circuit does not cut out when the cranking motor is not operating, and this causes full battery or generator voltage to go to the coil and through the breaker points.

The final item which may be a trouble spot is the ignition switch, a mechanical device which makes and breaks electrical contacts. Electrical contacts sometimes become corroded, burned or rough due to long use, and may introduce high resistance into the primary ignition circuit. High resistance at any point in the circuit will cut the circuit voltage and reduce the effectiveness of the system.

LOCATING IGNITION SYSTEM TROUBLES

The voltmeter is one of the most useful instruments for finding trouble in the ignition system. By comparing the voltage across the battery with the voltage from the battery side of the distributor (or where there is a resistor in the circuit, to the battery side of the resistor), any serious voltage drops in the circuit, including the ignition switch, will be apparent. By checking each part of the circuit the high resistance point can be pinpointed.

A portable test light is very convenient for picking out dead circuits or points that should be "hot" but are not. With such a tester, the clip is attached to any good ground. When the prod is touched to a live spot in a circuit, the bulb will light up. Thus in making a check to see if current is getting to the coil, to the distributor or the resistor, the test light can be used to advantage.

The ground circuit can be checked with the voltmeter by getting the voltage drop from the distributor base to the grounded battery terminal. The drop across the points can be gotten either with a voltmeter that will read to tenths of a volt or with some makes of dwell meter.

The wires (both primary and secondary) can be checked by visual inspection for the condition of the insulation, as can the high tension wire terminals.

To test the rotor, hold the end of the wire from the coil about 3/16" away from the rotor, with cap removed, and open and close the breaker points by hand, with ignition current turned on. If a spark jumps to the rotor, it is defective, since if it was good there would be sufficient insulating effect so the high voltage current could not ground to the distributor shaft.

While the automotive oscilloscope is still quite new to the service trade its use is gradually increasing. With the oscilloscope, the ignition system can be checked and troubles, if any, indicated in a matter of a minute or two. This is a very practical and useful instrument, and every tune-up man should get acquainted with it. For more about the oscilloscope, turn to the article on page 38 in this issue.

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Starting the big ones on cold mornings

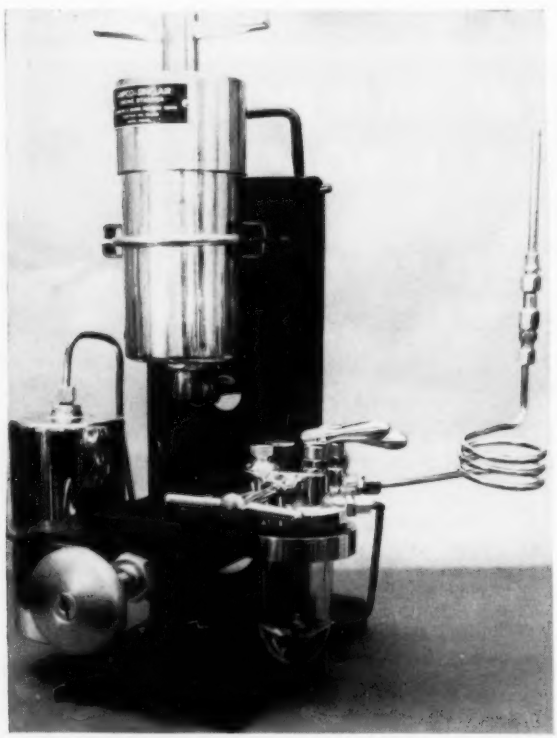
By E. S. HARRIS
Field Editor

A number of devices have been developed over the years to lick the problem of starting heavy-duty engines when the bottom falls out of the thermometer. One is of particular interest, since it is applicable to either gasoline or diesel power plants.

• COLD STARTS have been a problem on automotive engines since their very inception. Looking back into "history," the old timers' memory will dredge up all sorts of ingenious methods used for getting an engine to spring into life on a cold morning after a blustery, sub-zero night.

Some may recall the practice of squirting benzine into the cylinders through the priming cups often situated next to the spark plugs on the early engines. A lazy man's primer pump was sometimes situated on the instrument panel to allow a priming shot of fuel into the cylinders through auxiliary lines leading into the firing chamber without lifting the hood.

Also, there were manual compression releases that were simply a long rod connected to relief valves on the cylinders so that the operator could pull the rod and release compression on all cylinders until he could get the engine spinning with crank or starter. Then the valves were closed for the start.



This cold weather engine starter can either be a permanent installation on the engine or a portable unit can start several engines on the storage lot of a fleet.

THE PROBLEM IS STILL WITH US

That the need for cold starting assists can be relegated to the distant past is only a pipe dream, as many mechanics and truck drivers will testify. Starting heavy-duty engines on cold mornings is still no lead-pipe cinch—in fact, some of the diesel jobs prove rather reluctant to take hold when the temperature is only a few degrees below "balmy" (sometimes at the +70°F. level), and they grow progressively lazier as the thermometer dips downward.

When the temperature is below freezing they are joined in the hard-starting habit by gasoline engines which have the advantage of higher octane fuels and a spark plug, but are made sluggish by the cold engine oil which slows the cranking speed and steals ignition current.

ENGINEERS HAVEN'T BEEN IDLE

Engineers haven't been idle in trying to alleviate this hard starting difficulty for engines of all types, and a number of starting assists, including warmers and injectors, have been developed in the last few years. In addition, several new oils have been developed and oil-thinning preparations compounded, the severity of the weather and the type of engine dictating their application.

One starting device in use on a number of heavy-duty engines (both military and civilian) which is particularly interesting, since it may be used on either gasoline or diesel power plants, is the AMPCO-Sinclair engine starter.

A starting fluid was especially developed by the research and development department of the Sinclair Refining Co. which is injected into the engine by a specially designed automatic device made by the Automotive and Marine Products Corp. The applicator relies on itself for starting technique instead of the know-how of the operator in carrying through the starting and running steps. Previously-used applicators depended heavily on the human element and therefore turned out some unpredictable results. They would work swell for one operator and foul up completely for the next.

WHY GASOLINE ENGINES WON'T START

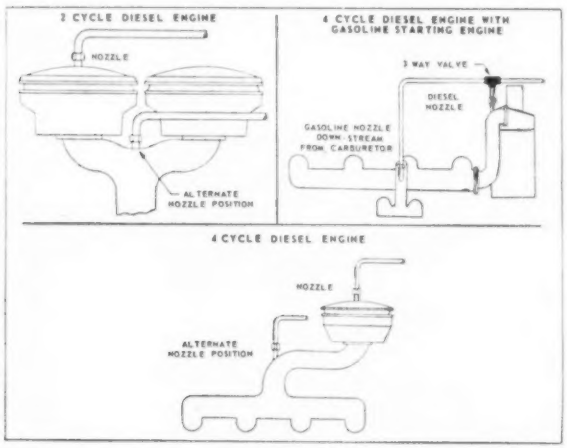
Poor, cold-starting characteristics of gasoline engines include various contributing factors such as low cranking speeds, inadequate ignition potential, fuel deficiencies, plug icing and fouling and carburetion mixing and distribution failures. The overload on the electrical system caused by the heavy starter draw at the time of a cold start results in the ignition weakness when a hot spark is particularly needed. And carburetion deficiencies result in the discharge of unmixed (raw) fuel into the cold

manifold so it cannot be distributed evenly to the several cylinders in the design as a combustible mixture.

WHY DIESEL ENGINES WON'T START

In the case of the diesel engine, poor starting characteristics are contributed to by the characteristics of the fuel (low cetane), fouling of the injecting system, inadequate pressure for spray pattern at the injection nozzles, low cranking speeds, reduced compression potential, mechanical deficiencies and low ambient air temperature.

Ignition of the fuel in a diesel engine is accomplished by the compression of an air charge in the cylinder which elevates the air mass temperature to a point where contact with the injected fuel will result in combustion. The normal ignition temperature of diesel fuel is 50°F. But cold, atomized diesel fuel, when injected under pressure in the combustion chamber at the proper timing cycle

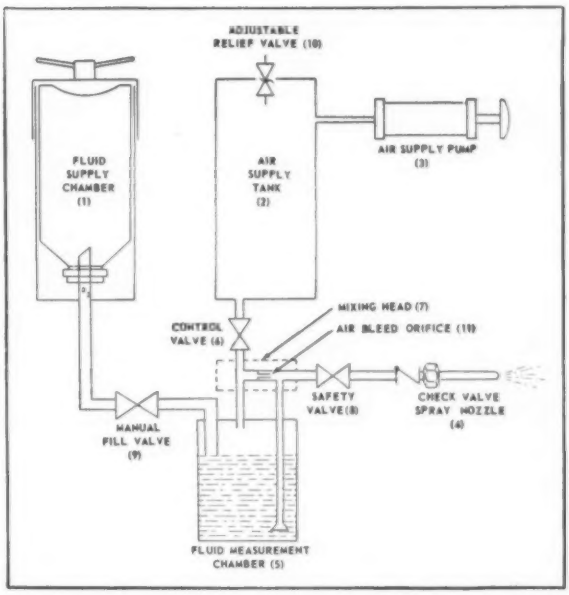


Typical nozzle location on various engines to best assist in starting.

often lowers the air mass temperature to a point below required auto-ignition temperature point, so the cooled, compressed air mass in the cylinder simply fails to trigger or ignite the fuel charge on contact.

SIX YEARS OF LABORATORY-FIELD TESTING

The AMCO-Sinclair engine starter and fluid underwent six years of laboratory and field tests, with engineers experimenting in refrigerated cold rooms at below-zero temperatures to provide an applicator and fluid which could deal with the cold starting problems in both



Drawing of the engine starter to show its operation in storage, measuring and injecting of starting fluid into the engine after mixing it in proper ratio with air under pressure.

gasoline and diesel engines. The combination of the material and applicator introduces into the engine an air-mixed and finely dispersed spray of starting fluid which has low temperature auto-ignition properties and is combustible at 350°F., a fully 300° gain which contributes to the rapid ignition and clean combustion of the primary diesel fuel.

Ignition of the diesel fuel is accomplished by the contact of the fuel charge with the saturated compressed air mass since the temperature of the prepared air charge will be raised rapidly either as a result of pre-combustion (pre-flame) reactions, or by actual auto-ignition of the air-mixed, vaporized starting fluid during the compression cycle.

Clean combustion of the primary diesel fuel is a result of prompt ignition of the fuel charge with the elimination of normal partial-combustion or pre-combustion reactions of the fuel charge during a low temperature, compression cycle.

In either instance, the composition of the special starting fluid and the method of introduction with the starter

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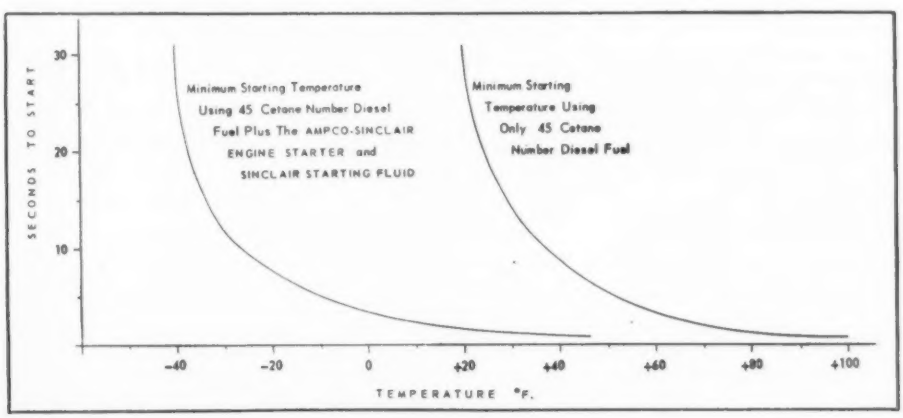


Graph indicating cold starts possible below regular temperature levels possible with standard diesel fuel.

Starting Big Ones . . . CONTINUED

applicator act as an effective "chemical spark plug" to facilitate clean, sustained engine starts.

TRIGGER-FAST IGNITION WITHOUT DETONATION

Starting fuels ordinarily employed usually consist of a compound of di-ethyl ether and light mineral oil or are straight di-ethyl ether, which has excellent ignition properties but is very difficult to handle and which can result in engine damage if introduced into the engine in excessive quantity or in too rich a proportion. Straight di-ethyl ether fluids are subject to severe detonation characteristics on compression or ignition.

The Sinclair Starting Fluid is compounded to inhibit against abnormal detonation and is pre-mixed with selective proportions when introduced into the engine by the AMPCO applicator. The fluid is a blend of di-ethyl ether and normal heptane. The rapid compression ignition properties of di-ethyl ether are employed to trigger the n-heptane base fluid to result in a progressive combustion reaction which will assure prompt ignition of the primary diesel fuel on contact.

The material is stocked in special 12-ounce metal containers which hold ten fluid ounces. The cap is not opened by the operator but is pierced and sealed within the bulk fluid container of the starting fluid applicator. This container was specially designed to withstand all indicated operating and storage pressures.

The fluid then passes from the bulk container into a reservoir which meters 52 cubic centimeters of the fluid for discharge, as required and indicated by engine size. (Optional equipment provides for continuous transfer of fluid from bulk container to metering reservoir when extreme cold weather conditions or military use dictates.)

The hand pump is pre-lubricated to function at extreme temperatures with a minimum indicated potential per stroke of two pounds. The air reservoir which holds a minimum of 500 cubic centimeters of compressed air is constructed to meet I.C.C. requirements. The control head includes components to filter the air, a pressure regulator, automatic and manually controlled valves, etc., to safely control the fluid and air mixture and inject it in the manifold of the engine under pressure as a finely dispersed and rotating spray.

TWO INDEPENDENT CIRCUITS EMPLOYED

This engine starter *does not* employ the usual hydraulic ram principle (fluid under pressure from a piston through a restrictive orifice). Instead, two entirely independent circuits have been provided for in the construction of the auxiliary applicator. The air circuit accumulates the air under pressure for the source of energy and pressurized air is used to control the volume, relative proportions, and the flow curve characteristics of the air/starting fluid discharge into the engine.

The fluid circuit provides for the required starting charge of fluid (52 cubic centimeters, minimum), with the reserve charges stored in the bulk fluid container. Automatic metering and flow curve characteristics are supplied by the selection of the indicated pressure setting of the pressure relief valve according to the operating chart that accompanies the device.

All controls on the starter are large enough to be operated with gloved hands and are available to the operating position so that starting is a one-man operation. Up to 60 individual starts can be made from one can of starting fluid. The quantity required depends, of course, on the size of the engine and the temperature, as at lower temperatures more fluid may be required to "follow up" the start, and keep the engine running for the critical few seconds after first firing.

Fleet operations often make use of a single, portable starting unit which may be used to make several starts on several vehicles with one applicator. Permanent installations are then only necessary on vehicles that require starting away from the home base.

Use of the apparatus has been approved for use by several engine manufacturers as well as being approved for military and general government use where low temperatures cause starting difficulties.

Chrysler 300D

● FUEL INJECTION, aircraft-type bubble windshield and Auto Pilot driver assist—these are but just a few of the features available on Chrysler's sport-type 300D.

Power for this recently announced 1958 model is supplied by a 392 cu. in. FirePower V-8 engine with an increased compression ratio of 10:1 and a horsepower

The Chrysler 300D

of 380 at 5,200 r.p.m. Bore and stroke are 4.0″ x 3.90″. When equipped with the electronically controlled fuel injection system (optional), horsepower is boosted to 390 at 5,200 r.p.m.

The 300D has low horizontal lines, a sleek-sculptured steel body, an overall height of 55.2″, overall length of 220.2″ and high-swept tail fins which end in new wide-flair tail lights. Dual headlights are set above twin air scoops which cool special 12″x2½″ total contact power brakes. Simple red, white and blue "300D" insignia is set into trim to identify the car, which is available in two-door hardtop and convertible body styles.

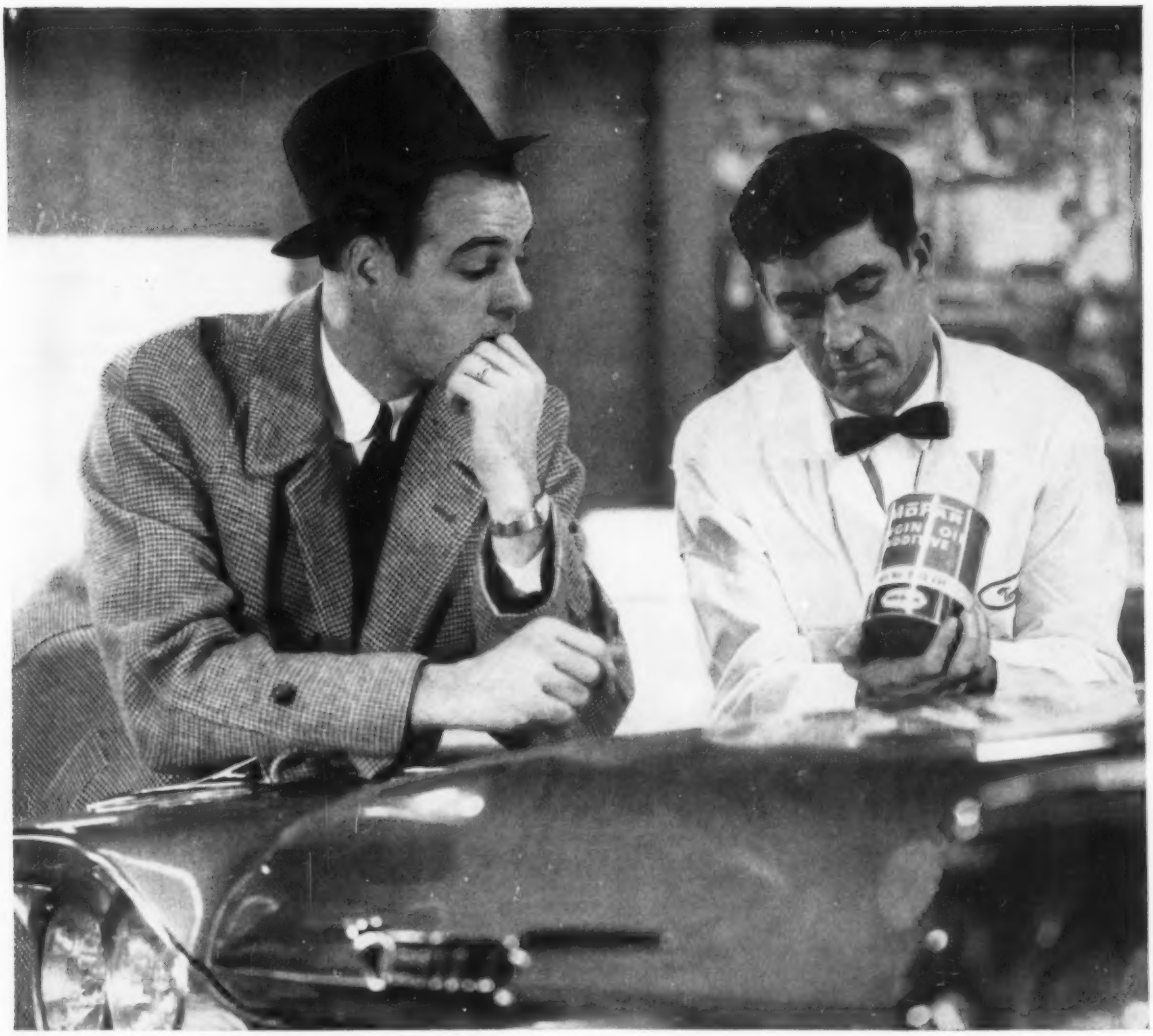
The car has a 126″ wheelbase, a rear axle ratio 3.31:1 and a wide range of optional rear axle ratios. It features TorqueFlite, pushbutton automatic transmission and improved power steering. Manual transmission is optional at extra cost.

Overcharging Air Conditioners Can Cause Clutch Failure and Belt Slippage

A recent service bulletin from the Dodge Division of Chrysler Corp. states that when charging the air conditioning system with refrigerant a 3 pound charge may cause excessive head pressures which may possibly result in premature clutch failure and belt slippage. Therefore, it is recommended that when charging a front mount unit the system be charged with 2⅝ pounds plus or minus ⅛ pound.

A front and rear combination unit (available on 1958 Wagons) requires 3⅞ pounds plus or minus ⅛ pound.

When the unit is properly charged, it is possible that an occasional bubble may be observed in the sight glass, when the engine is idling or when the clutch is ready to cycle. This does not mean that the system is not fully charged and will not affect the capacity or efficiency of the unit.



Sell longer life, better performance —with MoPar Engine Oil Additive

You've got a lot of extra sales *made* when you make these points to your customers:

MoPar Engine Oil Additive adds measurably smoother engine performance and longer engine life.

MoPar Additive and Additive Concentrate are formulated to do the most effective job of neutralizing corrosive acids, retarding rust, keeping hydraulic valve lifters, piston rings, valve stems and guides free from harmful deposits, and resisting wear.

Selling your customers on those facts—and on the quality they always get with MoPar—can quickly add up to profitable *repeat* business for you. MoPar means *official, authentic* Chrysler Corporation products, made to Chrysler's uncompromising standards. For quick service, call your MoPar wholesaler salesman or your Plymouth, Dodge, De Soto, Chrysler or Imperial dealer.

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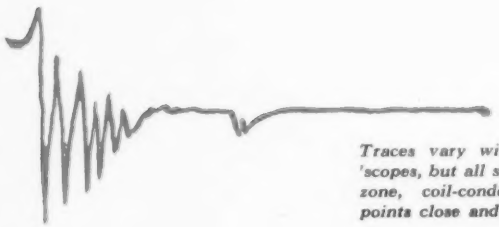
DETROIT 31, MICHIGAN

By GUY F. WETZEL
Technical Editor



Traces vary with different 'scopes, but all show a spark zone, coil-condenser zone, points close and dwell zone.

The critical demands for precision breaker point opening, closing and extinguishing the arc (spark) in our modern, high horsepower engines is bringing into sharp focus the growing need for . . .

Oscilloscopes—seeing eyes of ignition

• FOR MANY YEARS the cathode ray oscilloscope has been used for observing and interpreting electrical phenomena and mechanical operations capable of conversion to related voltage or current variations.

In recent years the oscilloscope has come to the front in automotive service as an analyzer of ignition and engine performance. With the engine operating, the instrument checks concurrently the individual action of the ignition coil, distributor, spark plugs and condenser. The image or trace on the screen discloses actual cause and location of malfunctioning. Once the operator becomes familiar with the indications of the trace from one make of 'scope he will understand the traces of other makes because all have a spark zone, coil-condenser zone, points-close and dwell zone which are easily identified.

DOES NOT REPLACE TEST INSTRUMENTS

The oscilloscope is not claimed by any supplier to replace accepted test instruments. But it has already demonstrated that it gives information about the ignition system that can be gotten in no other way. It also can be used to advantage to gauge the results of corrective measures in engine tune-up jobs.

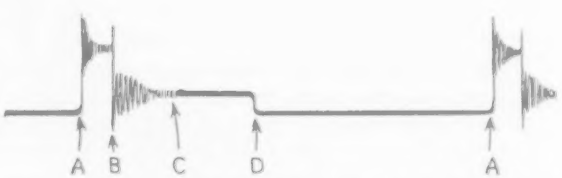
Various makes of oscilloscopes were discussed in the August 1957 issue of this publication, and mention also was made of a 'scope, furnished by the maker in kit form, to be assembled by the purchaser. This is the Heath Ignition Analyzer, which, although it will not do what the larger and more costly instruments can do, provides a good entry for the smaller service establishment to get into the field of testing with oscilloscopes.

By assembling the Heath unit, it follows that the "innerds" of a 'scope will be more fully understood and when the time comes for purchasing one of the larger and more comprehensive units, the shopman will have laid the ground work for practical and precise oscilloscope testing.

An essential part of the kit is a well-illustrated manual which gives information on the kind of soldering that must be done to assemble an instrument of this kind, step-by-step detailed instructions with provision for checking off each operation as it is completed, and an analysis of the scope circuitry.

CONSISTS OF VARIOUS SUB-ASSEMBLIES

The chassis is divided into various sub-assemblies, and every contact point is numbered and described. Taking the various parts, one at a time, exactly in accordance with the directions in the manual, one is surprised at how quickly the sub-assemblies are completed. All the resistors are color coded and described, so that by using reasonable care they will be accurately selected and placed.



The basic trace of the Heath instrument. A, is the firing line. A to B, is the sparking zone, B to C, the discharge of the remaining energy in the coil and condenser after the spark is extinguished at B. C to D is the inactive coil primary voltage, and at D, the points close sending battery or generator voltage through the coil. D to A represents the dwell.

The first assembly is the Trigger Sub Chassis, made up of 7 resistors, 2 small ceramic condensers, one .047 microfarad condenser, two tube sockets, a 5-lug terminal strip, wire, and aluminum flanged plate on which the parts are mounted.

The next assembly is the Sweep Sub Chassis. This is made up of 11 resistors, 3 tube sockets, a 3-lug terminal strip, a 5-lug terminal strip, a .047 mfd condenser, wiring, all mounted on a flanged aluminum plate.

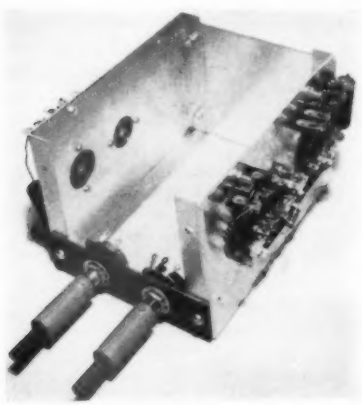
The third assembly is the Power Supply Sub Chassis. This includes 3 resistors, 2 tube sockets, low voltage filter condenser, high voltage filter condenser, one 2-lug and one 3-lug terminal strips, wiring, all mounted on a flanged aluminum plate.

The front panel is the fourth assembly. Mounted on the front panel of the instrument are the fine speed adjudgment, left edge control, 3 condensers, signal light, coarse speed control, and lead in wire connections. Included also are the ring to support the front end of the picture tube, the green colored screen on which the trace appears, and the front shading frame around the screen.

ASSEMBLING MAIN CHASSIS

With these sub-assemblies completed, the next step is assembling the main chassis. The Trigger Sub Chassis and Sweep Sub Chassis are bolted together with a stiffener plate at the rear end and an insulating strip across the front. In this strip the Focus and Intensity controls are mounted and fitted with insulating extension shafts.

The main chassis is an aluminum plate 6½"x19" with sides and front flanged downward and back end flanged upward. On it the Trigger and Sweep Sub Chassis are mounted between the side flanges. Just back of this group



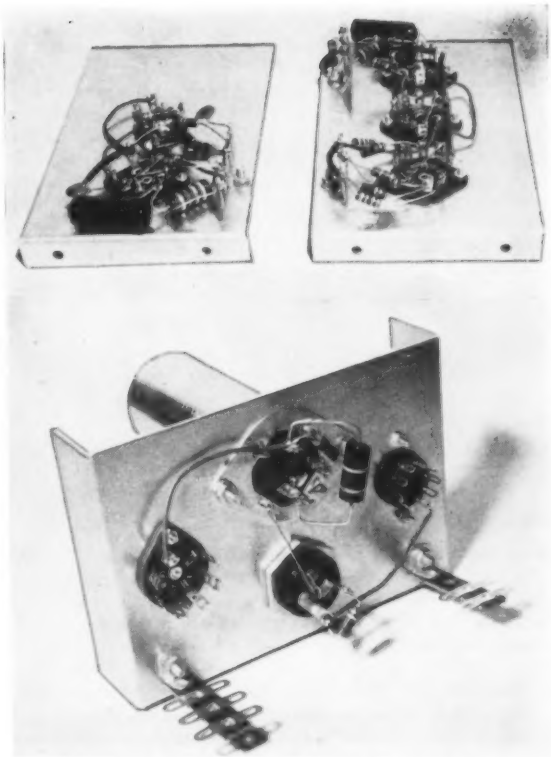
Trigger and sweep sub-chassis assembled together with the intensity and focus controls.

the Power Transformer is attached. It has four leads on one side and seven on the other. Back of the Transformer, the Power Supply Sub Chassis is mounted on the main chassis.

A cable harness with all the wires necessary to complete the wiring and with the nine-point picture tube socket attached, is furnished with the kit. The harness has 32 leads branching off at seven different points (or breakouts) and serves to connect the transformer, the controls, the filter condensers and socket contacts not previously connected.

ENDS OF ALL WIRES MUST BE TINNED

A caution that we found to be necessary to observe is to carefully tin the ends of all the wires before putting them in place and soldering. The current values in the various circuits are so small in this instrument that unless every soldered joint is a good electrical conductor, the



Top: Trigger sub-chassis and sweep chassis. Both are on a flanged aluminum base. Lower view: Power supply sub-chassis which carries two filter condensers and two tube sockets.

finished job will not operate as it should, if at all.

While working on the main chassis the sub assemblies and the transformer and side flanges, will be up, but they are underneath after assembling the picture tube and front panel.

The final assembly calls for putting the CR tube (picture tube) in place, putting the 9-point socket on the contact pins on the end of the tube, putting the 7 radio-type tubes in place, making up and connecting the lead-in cables.

The time required to assemble the instrument, according to the supplier, is from about 8 to 20 hours. It took the writer about 12 hours to do the job.

WHAT THE OSCILLOSCOPE DOES

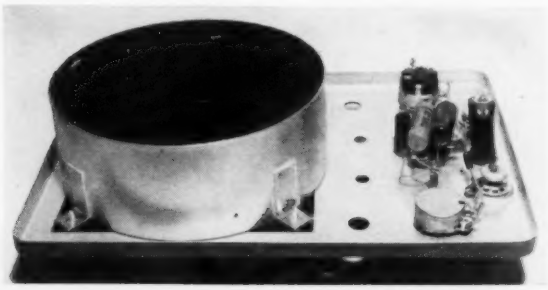
The oscilloscope as adapted for use on automotive ignition system, shows a picture or "trace" of the variations in voltage during one engine 4-stroke cycle or fraction of a cycle. In other words, it shows a curve, or graph, the height of which at any point across the screen, is proportional to the voltage existing in the ignition circuit at the corresponding point in the rotation of the distributor shaft and breaker cam.

Each time the distributor shaft makes one revolution, there will be 6 or 8 sparks generated in the ignition system, depending on whether the engine has 6 or 8 cylinders. The scope shows a voltage-time picture of each spark cycle from the instant the spark occurs to the time the breaker points open for the following spark which occurs in the next cylinder to fire in accordance with engine firing order. The instrument controls make it possible to see all the spark traces on the screen at one time, or any one of them, expanded for detailed observation.

(Continued on following page)

Oscilloscopes . . . CONTINUED

The Heyer, DuMont, Sun and Anal-O-Scope oscilloscopes show voltage changes in the high tension circuit, but the Heath analyzer gets its signal from the low tension circuit. However. by comparing the traces taken from the HT and the LT circuits, from the various 'scopes on the market, it will be seen that they correspond in most particulars, so that the trace seen on the Heath scope is quite informative when understood. The traces taken from



Assembly on the front panel, showing the inner side. The ring is the front support of the picture tube.

the HT circuit must also be understood in the same way to have any value.

INSTRUMENT CONTROLS

Let us first consider what controls are needed so that we can get the desired information from the use of the instrument, we will find that the desired controls are provided. To locate the trace vertically up or down on the screen in the desired position, we would look for the knob marked "Vert Center" and find it in the *upper left* corner of the control panel.

Next, we would want to be able to locate the trace left or right to get it in the best position. The *lower left* knob controls this. By turning knob right or left, we can center the trace or move it right or left. With expanded traces of each cylinder, we can move them at will across the screen, one after the other. This control is marked *"Left Edge."*

Very important is the width of the trace of each cylinder. We may want the traces of all 6 or 8 cylinders to appear on the screen at once, or we may want to expand the traces of the respective cylinders for more detailed examination. The *lower middle* and *lower right* knobs let us control at will the number of cylinder traces that appear on the screen and the width of each one. The lower middle knob is marked "Coarse Speed" and has three positions, increasing the width of the trace as it is turned from left to right. The lower right knob is marked "Fine Speed" and gives a finer adjustment of the trace width than the "Coarse Speed" control. To get the desired width of trace, turn the "Coarse Speed" to the approximate width that is wanted and set it precisely with the "Fine Speed."

This ignition analyzer can be controlled to show all 6 or 8 cylinders spread across the 4″ wide screen. It can open up each cylinder trace to about 1½″ wide and then by means of the "Left Edge" control, move the trace across the screen so each one of the 6 or 8 cylinder traces can be seen individually.

By turning both the "Coarse Speed" and the "Fine Speed" knobs to the right, a single cylinder trace can be widened so much that it would be 12″ to 14″ long, if it were visible. With the 4″ screen only part of the widened trace can be shown, but the most important and informative portion of the trace which is the Spark Line and Coil-Condenser section, can be seen in detail.

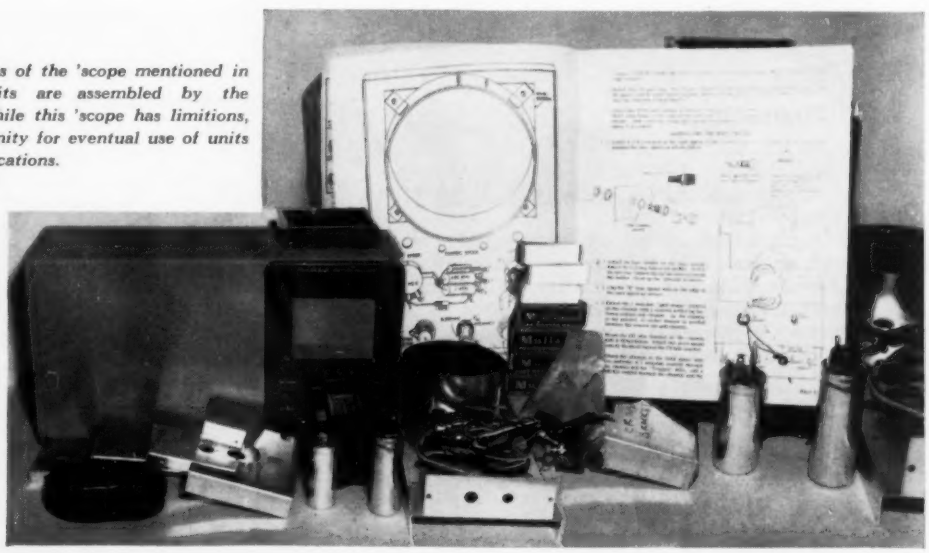
The "Trigger" control, located at the upper right, is very sensitive and must be set to give the best and steadiest trace. This will usually be turned about ¾ turn from its counter-clockwise stop position. When once set, it requires adjustment infrequently.

The "Intensity" and "Focus" small knobs in the top row center, can generally be left alone after once setting them to give the cleanest and sharpest trace. Of the seven controls, only the three at the bottom are usually operated when the instrument is in use. Actually the controls are simpler than those on a television set. The three referred to are (1) Left Edge, (2) Coarse Speed, and (3) Fine Speed.

CONNECTING TO THE ENGINE

The voltage lead attached to the contact marked "Breaker Points" is clipped to either the distributor side

Material and parts of the 'scope mentioned in this article. Units are assembled by the purchaser, and while this 'scope has limitions, it affords opportunity for eventual use of units with greater applications.

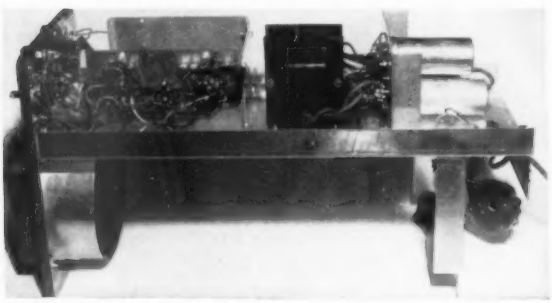


A well-illustrated manual gives step by step procedure for assembly as well as testing and using the 'scope.

of the coil or the distributor terminal with the red clip. The black clip goes to any good ground on the engine. The other lead which is connected to the contact on the instrument marked "Spark Plug Wire" is clamped over No. 1 spark plug wire, picking up its signal through the rubber insulation, with the clamp acting as one side of a condenser and the wire inside the insulation acting as the other side. This impulse or signal "triggers" the trace.

The "trigger" lead can be connected to any one of the 6 or 8 spark plug wires, and the traces shown on the screen for each cylinder will be in the same order as the firing order, beginning with the cylinder to which the "trigger" lead is attached.

The trace will show either negative or positive voltage,



Looking at the assembled chassis, except for the picture tube, in an upside down position. Note the power transformer just right of the center of the chassis.

with direction of each dependent on the polarity of the primary current. On positive ground ignition systems (all except GM cars prior 1956) the "hot" side is negative. This will show up on the screen by having the trace above the "O" or base line. Positive low tension polarity will show the trace below the base line. On the Sun and Heyer oscilloscopes, with the signal picked up from the high tension ignition circuit, negative voltage will be shown above the base line. On the DuMont, negative voltage is below the base and positive voltage above. Since all high tension ignition circuits should have negative polarity, the scope can be used to check HT polarity.

On negative ground cars, with the Heath instrument, to get the trace on the screen so that negative voltages read upward, connect the Black (or ground) clip to the distributor side of the coil or to the distributor terminal, and the Red clip to a good ground. It seems to be somewhat more convenient to have negative voltages show their trace above the base line. This can be done on all cars by having the Red clip connected to coil or distributor on positive ground ignition systems and to a good ground on negative ground systems.

The "O" or base line is at the level of the trace after the "points close" point on the trace, which is also the beginning of the "Dwell" part of the trace, with voltage at point of connection to the LT system substantially at zero.

THE BASIC TRACE PATTERN

Referring to the lower graph on page 38. the basic requirement for understanding the indications of the oscilloscope is to know the significance of each part of the trace. For example, on the typical trace shown, A-B represents the duration of the spark, which shows high frequency oscillations in the low tension circuit of the ignition system. Anything that affects the spark—distributor rotor, HT lead from coil to distributor, wires to plugs, and high tension voltage—will have its affect on the "spark" portion of the trace. At B the spark is out.

From B to C we see lower frequency oscillations representing the oscillatory dissipation of the energy remaining in the coil and condenser. Therefore, trouble in these units will affect this part of the trace, and deviations from the typical pattern will indicate defective operation.

From C to D the line represents the ignition primary voltage, which will be 6-volts on 6-volts systems or about 9-volts on 12-volt systems with series resistors in the ignition primary circuit.

At D the points close and voltage across the points will drop to just about zero. The distance from D to A represents the relative time the distributor breaker points are closed. The vertical distance from the "Points Open" line to the "Points Closed" line is proportional to the low tension voltage in the circuit, since there will be battery or generator voltage on the distributor side of the coil with points open, which will drop to zero except for the tiny resistance across the points when they are closed.

At the beginning of the first trace which is the trigger cylinder, the firing line is missing because the spark fires during the time the point of light which generates the trace returns from the right side of the pattern to the left end to begin a new trace, just like the point of light which draws the picture in a television picture tube. On the other cylinders, the trace is complete with the firing line shown at A.

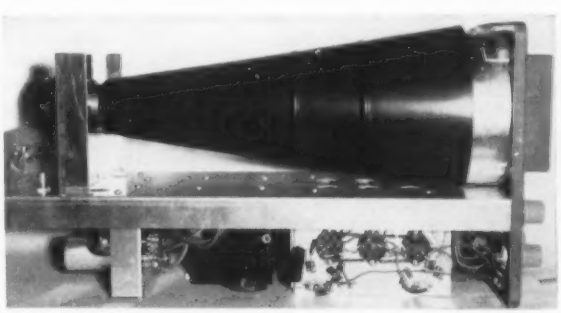
The height of the firing line at A is proportional to the voltage required to fire the plug. Therefore the height of the line and the shape and length of the spark line will give some indication of the sparking voltage and the available sparking energy supplied by the coil and condenser, modified by the voltage from the battery or the generator.

The length of the trace of one cylinder represents one fourth of a turn of the crankshaft or 45° of rotation on the distributor shaft on 8-cylinder engines. On 6-cylinder engines the single cylinder trace would correspond to one-third of a turn of the crank shaft or 60° of distributor shaft rotation. Therefore, on an 8-cylinder engine, with the engine speed 600 rpm, or 10 revolutions per second, the cylinder trace represents 1/40 second in elapsed time. The spark duration, represented by A-B is about 6% of this period or roughly 1/660 second. If the engine runs at 1200 rpm the spark duration would be 1/1320 second. At higher engine speeds, the spark duration is about the same but the dwell is reduced proportionately, which will give some indication of how fast the ignition system has to work.

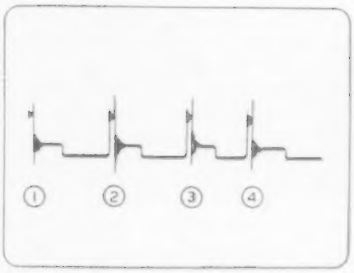
INTERPRETING THE RESULTS

The first essential is to understand the basic trace pattern. There is a close relationship between the high tension trace as shown on the Heyer, DuMont and Sun

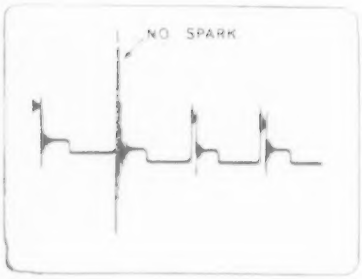
(Continued on following page)



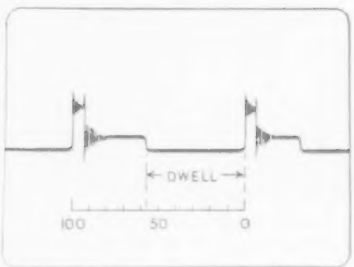
The completely assembled chassis ready for insertion in the case. The picture tube is shown in its protective casing.



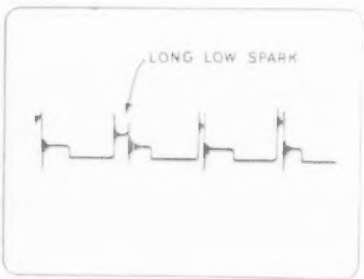
Trace showing the action of four cylinders. All cylinders as shown on the screen follow each other as the engine firing order.



Trace showing how a defect appears. This is the effect of an open circuit as it applies to a spark plug circuit.



Dwell is measured by setting the pattern for one cylinder to coincide with length of calibrated scale on the screen of the unit.



Trace showing another defect. In this case, it's the effect of a partially shorted or shorted spark plug or wire.

Oscilloscopes . . . CONTINUED

oscilloscopes, and the low tension trace as shown on the Heath, which can be seen by referring to the illustrations. With different cars there will be slight differences in the pattern, but the basic phases will all show up in the same way—firing line, spark line, coil-condenser line, points close section and dwell.

An important point should be kept in mind in working with the oscilloscope—there are two spark gaps in the HT ignition circuit, so that even if a spark plug is shorted out entirely there will still be a gap between the tip of the distributor rotor blade and the distributor cap contact. Therefore, there will be a spark pattern, though it will be at lower level and the spark line will be longer.

THREE BASIC QUESTIONS

When checking an ignition system there are three basic questions that should be answered the first thing. They are: (1) Is the pattern normal? (2) Are the variations (if any) common to all cylinders, or less than all? (3) What part of the trace is affected?

Variations will show up at the firing line, the spark line, the coil-condenser line, the points close signal and length of the dwell line.

The answers to these questions will give a clue as to the location of the trouble if this is in one or more cylinders. For example, if the trouble is indicated in one or more but less than all cylinders, it will be between the distributor rotor and the spark plugs, which could be plugs, wires, distributor cap, rotor, or within the distributor body. If it affects all the sparks, in the same way, the trouble will have to be ahead of the distributor, in the coil, condenser, coil-to-distributor wire, resistor on 12 volt systems, breaker points, or primary wiring.

The Spark Zone: High resistance in the HT circuit will make the firing line higher and the average level of the spark line also higher but shorter. A wire off a spark plug causing an open circuit, will show a fainter than normal spark firing line, but much higher and also extending at least half the distance below the base line, with faint but wide amplitude vertically, blending into a poorly defined coil-condenser line or zone.

If the section A-B is abnormally long with a lower average spark line there is a long duration spark operating on a low voltage. This would indicate a partially closed spark plug gap or a shorted plug or wire, making the distributor gap the only spark gap in the circuit.

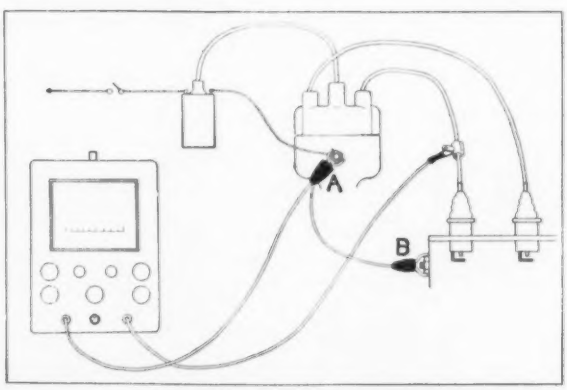
Note that the trace of the triggering cylinder does not have a firing line, because the time of returning the generating spot to the left uses up the instant required to show the firing line on this cylinder.

In examining the spark zone, watch both the length of the line and the level of it and the firing line. If the center line of the spark zone bends downward to the left, it indicates high resistance in the HT circuit.

Coil-Condenser Zone: There should be at least five waves or wiggles in the part of the trace which shows the coil and condenser action, as the after-spark energy in this part of the ignition system is dissipated. Shorted turns in the coil secondary or a leaking condenser will tend to flatten out the waves and reduce their number. This zone may move right or left as the spark line increases or decreases in length, but the form and number of waves are the important features to be watched.

Points-Close and Dwell: The vertical distance from the

(Continued on page 69)



Showing how the analyzer is connected to the engine. On positive ground systems the red clip, A, is put on the coil and the black clip, B, grounded to get the trace above the base line. On negative ground systems the red and black clips are reversed.

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THE BUILD IT YOURSELF "KID'S CAR"... RUNS 5 to 8½ MILES PER HOUR WITH A "TRADE-IN" ENGINE FROM THAT USED MOWER!

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You'll find every wanted type of power mower in FALLS and ROTO CLIPPER lines, including reels, rotaries, riders self-propelled, electric starters and promotional numbers

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YES, SEND ME FULL DETAILS ON YOUR BUILD IT YOURSELF POWER MOWER PROMOTION. Write Dept. A.S.D. 1.

Name .....

Address .....

( ) I am a distributor.
( ) I am a dealer.
( ) I am interested in Falls.
( ) I am interested in Roto Clipper.

FALLS PRODUCTS, INC. GENOA ILLINOIS

Resolved for 1958:

. . . to boost shop profits

• HOW MANY REPAIR JOBS have you done without charging for during the past year? On how many jobs did you donate the needed parts?

Don't be too quick to answer.

A car dealer recently said to us, "You just *can't* make money in the shop these days."

The record shows, however, that this is not true. In many establishments the shop is *the* money maker.

But, this dealer had a point, so we said, "Let's go over some of your repair orders."

REPAIR ORDERS INCOMPLETE

We did. A good-looking order that should have proved profitable covered a complete engine overhaul. There were pistons, rings, pins, bearings, timing chain, valves, valve springs and gaskets. Yes, they even charged for the oil, which many shops forget to do. Everything looked fine. And then we discovered that there was a set of generator brushes and a generator bearing listed in the parts column. There was also a carburetor overhaul kit and some distributor points billed.

All well and good; but where was the labor? Search as he could, the dealer could not explain why there was no charge for overhauling the generator, rebuilding the carburetor, or replacing distributor points. These were all justifiable *labor charges that had not been made.*

Within the next hour, several other similar repair orders were analyzed. A couple of them were the other way around. One was a brake reline job on which no material had been used—if we were to believe the repair order. Oh, yes, hanging on the parts room wall was a slip of brown paper calling for a set of shoes, wheel service cylinder kits, and a few other items which the parts man "thought" were entered on the repair order by the mechanic.

The situation was bad, and the dealer was right. The shop was *not* profitable. But the loss was chargeable directly to management.

DELEGATE THE RESPONSIBILITY

A good mechanic should not be expected to be a good bookkeeper. A good mechanic may have his hands so dirty that it would be unwise to have him make the entries for parts consumed.

It is the responsibility of the shop owner to see that some one charges for all labor required and for all parts used.

And before you pass this off as a cock-and-bull story, you'd better just get out your repair orders and check them over because *it could happen to you.*

THOSE "INCIDENTALS" COST MONEY

Along this same line, but not quite so serious, is the matter of cost for small parts and supplies such as oleum spirits for cleaning up, tape, safety wire, cotter pins, lock washers, gasket cement and such, *used* in greater or less quantity *on every job, but rarely charged to any job.* Of course, if you can get these supplies free, then by all means pass along this benefit to your customer. But if you will add up your purchase orders for the past year, you'll find you paid a substantial amount of money for those incidentals required to keep your shop running.

We know that charging for these may cause hard feelings on the part of some customers. And the customers will be justified if an excessive charge is made. Yet one shop owner had a rubber stamp made up that said, "Average net cost to us for cleaning material, rags, tape, cotter pins, and lock washers used—25c," and the amount was put in the parts column. The charge was small enough so that no one was annoyed. But on every 100 repair orders there was an extra $25.00 that helped mightily in handling the cost of such essential material.

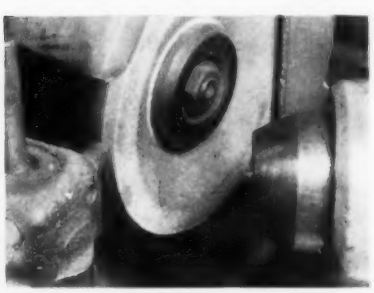
DEAD STORAGE IS COSTLY

Space costs money. Every car in dead storage in your shop or parking lot is a car that may be keeping another job from getting in. So be sure to check your routine with each customer to advise him that storage charges (at a good stiff rate) begin 24 hours after the repair job is finished. See that he is notified to that effect.

We have seen shops in which customers would order a trifling service operation and then conveniently "forget" to pick the car up. In the meantime they got free storage, and the shop took a good beating profitwise.

One shop licked this waste of space by having each repair order marked, "Your car will be placed in storage at your expense 24 hours after the repairs are completed." And then they followed through. Actually they turned the car over to a local storage garage, took the claim check and attached it to the customer's copy of

In this shop, all jacks and car stands receive a periodic inspection, which includes complete lubrication and fluid check.



Diamond dressing the wheel on the valve-facing machine, which should be used exclusively for facing valves, and not for "grinding an axe."

By ED PACKER

by cutting losses

Part six of a series of articles on shop management . . . designed to bring ASD readers the time-proved procedures of profitable service shops throughout the country

the repair order. In this way the customer learned that the repair shop meant exactly what was said. Furthermore, the financial dealing on the storage was with an entirely different organization, so that there was less hard feeling in the matter. Naturally a little good judgment was used in applying this essential rule. If the repair job was of considerable consequence, or the business of the customer highly important, the 24 hour standard limit for free storage was stretched a bit. But by and large the 24 hour rule prevailed, and this shop was remarkably free from dead storage congestion.

The shop's inventory of parts and supplies must be constantly checked so that when something is needed it is sure to be readily available.

ARE NEEDED PARTS ON HAND?

If it is important to get a car out when finished, it is equally important to keep it out until it can be worked on. This can't always be done, but one body shop has done especially well along this line by checking each repair job with the owner, and noting the parts that will be needed. For example, if a grille is required and is not on hand, or a fender is needed and must be sent for, or if chrome strips are to be replaced and are not on hand, then there's no sense in depriving the customer of his car and cluttering the shop with it while waiting for these parts. Consequently this shop did rather well by estimating each job, and arranging to pick the parts up, after which the car was called in. You wouldn't want to try this for every customer, for by the time you had the parts you might find that the customer had changed his mind or address. But it's just a thought that deserves a bit of attention, and which in some shops is proving helpful right now.

A distributor tester that is known to be in good shape builds mechanic morale, customer confidence, and shop profits.

PARTS MAN HOLDS THE KEY

You have probably been annoyed more than once by a store that was "just out" of something you wanted to buy. It made little difference whether it was a tooth brush or a

(Continued on following page)

Cleaning, oiling and inspecting brake service equipment during a "lull" keeps it in tip-top shape.

Management . . . CONTINUED

chocolate soda—you "want what you want when you want it." And the more conscientious the mechanic, the more you may be sure that he wants to spend his time working rather than walking.

The parts man, though his duties may range from service salesman to bill collector, is a key man in any shop. It is he who will see that not only are most needed parts on hand, but they are in good order.

No one is going to "borrow" a gasket from a carburetor kit so long as this parts man is around. Nor will they "trade" a part in doubtful condition for one that is in good shape. Call these trifles if you will, but when the habit of being "just out" develops in a shop and the mechanics have to wait for parts to be delivered from the nearby and hard-working jobber, the spirit of the mechanics reaches a new low—and so do the profits.

KEEP CLOSE CHECK ON EQUIPMENT

One day we saw a mechanic doing what appeared to be an old-fashioned hand lapping valve grinding job. With vacuum cup and valve grinding paste he was really spinning the handle between the palms of his hands in a way that we haven't seen done for many a year. So we let our long nose lead us closer, and risked a question.

"How come," we asked.

"Simple," says he. "There isn't a better grinding wheel in this county for touching up screwdrivers and cold chisels, than the one that we've got on our valve facing machine. But it's sure a lousy valve facer after the boys get through with it."

That shop needs two things: a good bench grinder, and a good tough manager. The alert shop owner will see that all equipment is used for the work it was intended for. He will see that the valve grinder wheel is kept dressed and in good shape for valve work—*and nothing else.*

It's the same fundamental with everything. To have enough of the right equipment to handle each job without lost motion is the sure route to profit.

Take water buckets, drain pans, air hose connections, electric light outfits and garage jacks. If you don't have enough of each in good shape, you are paying for them in lost profits but still ending up without them.

One of the illustrations shows, for example, the jacks in a shop that has floor space for 6 cars. This picture was taken on a Saturday morning, when the regular weekly check-up on the fluid level of the hydraulic jacks and the lubrication of all moving parts, is made. In this shop no mechanic ever yells, "Who's got *the* jack?"

In fact, we heard a variation of this remark one day. It was, "Who's got the jack that works?"

It's a pathetic situation when good mechanics—and there are such—have to not only hunt for a jack, but find one that works.

SHOP JUDGED BY ITS EQUIPMENT

Experience indicates that in those shops that have good equipment and keep it in good shape, they don't have too much trouble locating and hiring good mechanics. As might be expected, good mechanics just won't put up with shop owners or service managers who don't furnish good equipment. The old saying is that "you can tell a workman by his tools." And while this saying is so old that it practically has whiskers, it was never more true than today.

Every parts department maintains a "want" list. Every shop should also keep a *maintenance* list. We have seen a mechanic get out from under a car so often to make an extension cord stay put in its wall outlet, that the time lost was more than enough to repair the cord or the outlet. We don't know which was at fault — perhaps both. But it would have been cheaper by far to have put in a new outlet *and* to have cut 6 inches off the old wire and put on a new plug than to "fight" this condition—and still leave it to double cross the next user.

Perhaps it isn't always possible to repair instantly a thing of this kind that is causing trouble. In that event, make a note in the shop maintenance book, "Replace wall outlet at second bench" or whatever it is that would be a needed reminder. Then the job could be taken care of at the first opportunity. Or the note might read, "Put new connections on *all* drop cords," assuming all of them were bad, and commonly they all are.

IT'S THE OLD STORY

No? Well here's why we say that they are all likely to go bad. One goes bad, so you put it aside. Another goes bad, and you put it aside. Finally you have more put aside than you have available. And pretty soon you have a bushel basket full of drop cords that are just waiting to double cross the first guy who tries to use them as a power extension for the electric drill, or as a means of getting a little light on a job.

Of course the permanent answer is to install reel-type extension lights on the walls or on the ceiling. So the least you can do in the name of mechanic satisfaction and shop efficiency is to have the old-fashioned drop cords dependable even if they are awkward.

And what we said a little while ago about the fellow yelling for the jack that works is still heard on occasion by mechanics who need an electric drill. And there's just no excuse for doing with muscle what can be done better with machinery—if the machinery will work.

So it is the job of management to have on hand electric drills that do work. Fortunately, many jobbers and many suppliers of important shop equipment furnish maintenance service for what they sell. And there is nothing more expensive than *not* buying such service.

No one can tell you what your shop needs. But remember, "Small leaks can sink the greatest ship." And stopping so-called "little losses" can lead to an important and welcome increase in profits.

How to Remove Object From Combustion Chamber

Fortunately, it doesn't happen too often, but you may eventually be faced with a problem of removing a small foreign object from an engine's combustion chamber. When it does happen, here's a tip from the Champion Spark Plug Co. on quick removal.

If the material happens to be magnetic, it can be removed from the cylinder through the spark plug hole with a flexible magnetized rod. However, if the material is non-magnetic the following method is also suggested.

(1) With the spark plug removed, carefully crank over the engine until the piston reaches dead center *with both valves closed.* To check valve position, determine if the cylinder is holding compression or remove the valve rocker covers and check rocker arm position.

(2) If the spark plug hole is below the exhaust manifold, hold a mirror below the port to see when the foreign object is ejected.

(3) Attach a curved piece of copper tubing to the compressed air line. Insert the nozzle into the chamber and turn on full air pressure. In most cases the object will be blown through the port without further trouble.

* * *

Checker Cab Co. still has plans for manufacturing a 4-door economy type sedan for sale to the general public. While the car will follow the same construction as Checker Cabs, the company emphasizes that it will have many styling refinements so it will not look like a "cab without a meter".

Alignment . . . *(from page 21)*

the manufacturer's instructions are followed . . . the most important requirement is knowing and understanding front end geometry.

All of the later model cars, except Hudson, Studebaker and Willys, now use the ball joint front wheel mounting, without a king pin as such. However, the geometry is exactly the same as the older front end designs using a separate steering spindle, steering knuckle support and king pin.

This discussion would not be complete without mentioning the important and profitable service of wheel balancing. This work goes hand in hand with steering service; in fact wheel balancing often leads to steering service jobs. A large number of wheels need balancing to prevent tire cupping and uneven wear, which materially cuts down the mileage a tire will deliver satisfactorily. In this connection, dynamic balancing will definitely balance wheel assemblies which have unequal weight distribution, running at high speed. Static balancing will only balance wheels where unbalance is equally divided on each side of the center plane of the tire.

As with other types of equipment, there is a variety of types of equipment available for front end service. A somewhat bigger initial investment will pay in the long run, but it is possible to profitably get into front end work with a very modest investment and still do good work. The main requisite is the desire to get into this line of work, the willingness to learn how to operate the relatively simple instruments used and the understanding and mechanical ability to do the adjusting operations. Even without previous front end experience the necessary knowledge can be easily acquired.

Mastery of the basic principles outlined in this discussion will make it easy to comprehend the instructions that come with the instruments and obtain results that will be satisfactory to your customers and profitable to the shop.

The condition of the tire tread will give an indication of both the need for tire balancing and for front end alignment. Cupping of the tires shows that the wheels are out of balance, which is corrected by balancing them. Excessively rapid wear is due to wrong toe-in. Uniform wear around the tire tread, either inside or outside of the center of the tread, usually indicates wrong camber. Excessive wear could also come from wrong toe-out-on-turns due to a bent steering arm. Observation of each set of tires on cars that come into the shop will show which ones are candidates for additional service which can be sold in most cases merely by pointing out the need for the service.

This box full of worn ball joints which were replaced in a relatively short time in a busy shop gives an idea of the amount of this work that is available to the alert shop operator.

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Universal joint service

With the adoption of the three-joint propeller shaft assembly and present trend towards more universals, the independent repair shop should get its house in order to adequately handle this important and profitable service.

By BEN IKERT
Editor

• BEFORE COVERING specific types and makes of universal and propeller shafts some general information applying to the work follows. In the majority of cases the rebuilding of a propeller shaft assembly consists of replacing worn journal cross and bearings with a new kit. This replaces that part of the propeller shaft most subject to wear in operation. The slight off-center present in the journal cross assemblies make it desirable to rebalance the assembly.

Generally, unbalance resulting after replacing journal and bearing kit is equivalent to the unbalance existing after straightening. If rebalancing cannot be done, it is advisable to check the assembly for smooth operation in the car or truck before it is put into operation.

Occasionally it is necessary to revise propeller shaft lengths when rebuilding a vehicle. This job requires proper facilities to produce a quality assembly. It is necessary to properly assemble fittings into the tube and straighten before welding to be sure parts are centralized. This can be done by mounting the shaft assembly on the center and straightening at the fittings until the ends of the tube run concentric within about .005″ total indicated run-out.

The welding of the tube in the fittings must provide for adequate strength and prevent distortion which could cause excessive run-out. It is often desirable to tack weld and recheck for run-out before proceeding with the final weld. After welding, the entire propeller shaft should be straightened to the following limits:

.005″ run-out on shaft neck
.010″ run-out on ends of tubing 2″ from welds
.015″ run-out in center of tube.

These run-outs should be taken on the entire propeller shaft assembly

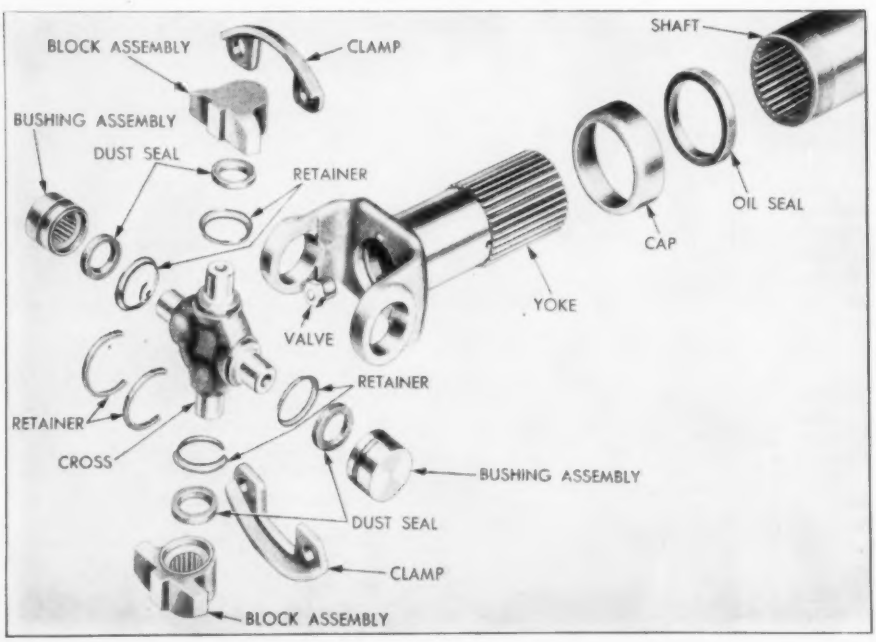


Fig. 1. Shown here is a completely disassembled cross type universal joint. Parts are placed in their relative location. To assure the same balance parts should always be marked when a propeller shaft assembly is taken down for service.

mounted on master attached flanges or yokes, selected for minimum off-center. The entire propeller shaft assembly should be dynamically balanced to eliminate as much unbalance as possible. During balancing, the propeller shaft again should be mounted on selected flanges or yokes

Fig. 2. Sleeve yoke and stub ball yoke type shaft.

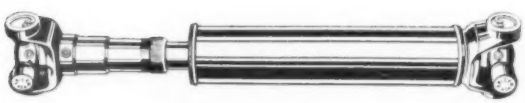


Fig. 3. This cross type shaft is typical of several makes.

of minimum run-out. If the propeller shaft assembly is lengthened, extreme care should be taken to be sure that the critical speed is not within the operating range.

LUBRICATING NEEDLE BEARINGS

Because lubrication plays such an important part in the proper servicing of universal joints the following pertinent facts, submitted by a maker of universal joints, is timely.

The needle bearings on the universal joint crosses require adequate quantities of lubricant for proper functioning. These bearings are factory lubricated at assembly with an adequate amount of proper lubricant to last until the first lubrication. Bearings removed from the universal joint crosses should be re-lubricated when re-assembled. SAE 140 or 250 straight mineral oil should be used. The straight mineral oil lubricants are preferred to a grease due to the separation of the oils from the fibrous soaps which can occur during rotation.

The centrifuge action in the bearings cause this separation and may result in the soap material hardening and clogging the lubrication passages. When this occurs, the passageways may be plugged solid enough to prevent adequate re-lubrication. The journal crosses can be re-lubricated through the centrally located lubrication fitting. Bearings should be re-lubricated until the oil appears at the bearing seals. The seals are capable of relieving the lubricant pressure without damage. The action of lubricant through the bearings and seals provides a flushing out of the water and contaminants in the bearing lubricant and aids in bearing life.

The sliding spline section of the propeller shaft can be lubricated with straight mineral oils the same as the bearings; however, a good grade of long fibre grease is preferred. For easier sliding action, extreme pressure (EP) greases have been adopted as standard at the factory. These lubricants reduce sliding friction and result in decreased wear on the sliding surfaces. It is very desirable to re-lubricate the spline section after assembly in the vehicle. This fills the cavity ahead of the spline shaft with grease which is distributed around the splines during rotation.

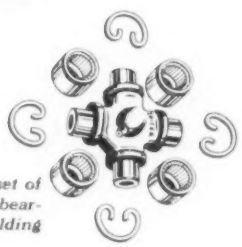


Fig. 4. Shop set of journal and bearings for rebuilding shafts.

The re-lubrication cycle required on the journal cross bearings and splines varies considerably with the type and conditions of operation. Under conditions where dirt and water can constantly get on the universal joint, a short re-lubrication cycle increases bearing life. It has been found that about a 3,000-mile cycle under these conditions provides adequate removal of the lubricant contaminants. Where a vehicle operates under more ideal conditions, the lubrication cycle can be lengthened to about 8,000 miles.

BASIC MACHINE SHOP OPERATIONS

The articles to come in this series will discuss removal, disassembly and reassembly of the various makes of universals. Also to be discussed is the duplicating of the original (or old) shaft sub-assembly, including identifying, measuring and duplicating assemblies.

In advance of subsequent articles, this month's article takes up basic machine shop operations, overall instructions and suggestions for doing universal joint work. Generally speaking, the shop specializing in universal joints will proceed along the following lines as advocated by joint manufacturers.

First of all the parts—all of them—are checked for wear and operating conditions. This is very important because experience shows that with 75% of drive lines with shafts to be straightened the component parts of the assembly also need servicing.

When disassembling the joints, pay particular attention to worn parts such as U-bolts, bearings, journal crosses, dust caps, cork washers, retainers, seals, pins, ball and roller assembly, centering buttons, thrust washers, grease covers, springs, boots, etc., which may need replacing.

(Continued on following page)

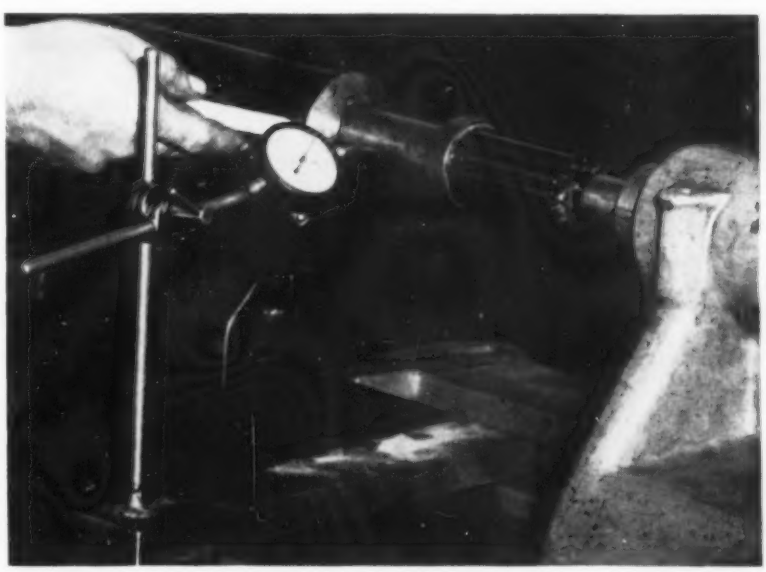


Fig. 5. Using a dial indicator on lathe bed for indicating buffed areas.

Fig. 6. Shaft with two ball yokes.

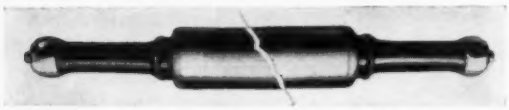


Fig. 7. Detroit ball type assembly.

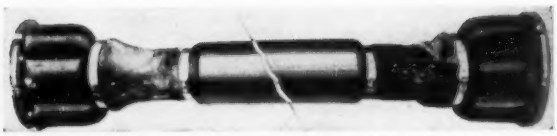


Fig. 8. Complete replacement drive shaft.

Fig. 9. Stub shaft removed from tube.

U-Joints . . . CONTINUED

When new parts are necessary, they show up more readily at disassembly. If new parts are required, time is saved by substituting immediately upon completion of the disassembly, rather than using valuable time by cleaning, oiling or greasing and attempting to reassemble before noticing the part needs replacing.

Be sure to use shop sets of journal cross and bearings for all phases of machining operations. Keep these sets available at all times and protect them when not in use. In using these shop sets, follow disassembly and reassembly procedures for the various makes of joints in coming issues.

Welding of stub shafts, stub ball yokes and ball heads can be done in the lathe. Be sure, however, to cover the lathe ways to protect them from the welding arc.

After finishing a weld, chip off the weld scale with the edge of a heavy file or with a small chipping hammer.

Inspect each weld made for cracks and pinholes. If pinholes are found, touch each with a weld. If a crack is found, turn weld off, cut "V" groove and reweld.

Although alignment of a new part is within .020" as suggested, there will still be a high side. Start all welds on the high side, which tends to pull the assembly into alignment.

In the case of fleet operators, always insist that the customer bring all of the parts that are to be repaired or replaced to the shop.

STRAIGHTENING CROSS TYPE SHAFTS

(Applies to any size Spicer, Blood, Cleveland, Detroit and Mechanics cross type joint and tube.)

Check all parts for wear and operating conditions. This alone, offers great possibilities for increased profit.

A-1. Remove sleeve yoke from assembly to be straightened.

A-2. From shop tools, select proper end yoke and assemble to shaft at stub ball yoke end with shop set of journal and bearings (Fig. 4).

A-3. Put collet adapter tool in lathe chuck and center for trueness.

A-4. Put assembly into lathe. The end yoke fixture that has been assembled to the shaft goes into the collet in the chuck.

A-5. Push up the tail stock to center in the stub shaft.

A-6. Tighten the collet cap screw to drive assembly in the lathe.

A-7. Buff the tube in three places to obtain a clean surface for indicating run-out (each end and center of the tube).

A-8. Use the table indicator on the lathe bed and indicate at buffed areas (Fig. 5). The total run-out should be within .005" at each end and a maximum of .020" at the center of the tube.

A-9. If the run-out exceeds these tolerances, straighten within the limits as follows:

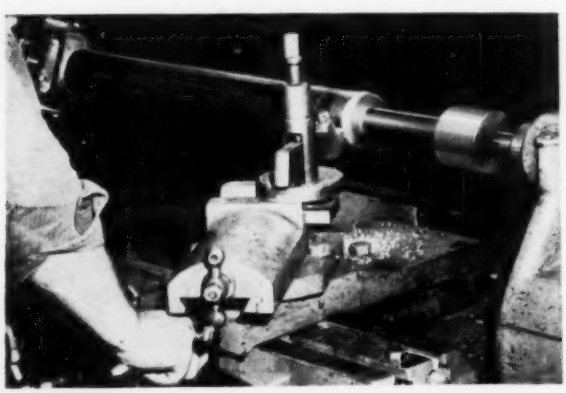


Fig. 10. Making a V-cut in tube at point of weld.

A-10. While the assembly is in the lathe mark the high spots on the tubing with a piece of chalk.

a. Turn assembly so the high side or side marked with chalk is on the underside.

b. Place a steel plate, cut to fit, between the lathe ways to form a shelf.

c. Place a small hydraulic jack on the shelf so the jack ram contacts

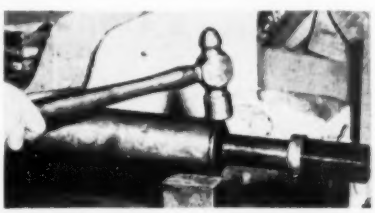


Fig. 11. Expanding tube with brass hammer to make stub shaft removal easier.

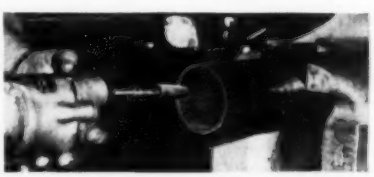


Fig. 12. Removing flash from inside of tube with a rotary file chucked in an electric drill.

the tube at the marked area at point of weld. Now put a slight pressure on the shaft from this position.

d. Repeat this operation at the opposite end and indicate again for run-out.

e. If the ends are running true and the center is still beyond the limit, mark high area with chalk.

f. Remove the assembly from the lathe and place in "V" blocks on the table of the small hydraulic press.

g. Turn the assembly so the high side is facing up to meet the press ram coming down and apply slight pressure at the high point.

h. Place the assembly back in lathe

Fig. 13. Heating end of tube to expand it for easy assembly.

and check run-out again as in operation A-8. If shaft is not within limits repeat preceding operations f and g until the assembly is within the above limits.

A-11. Remove from the lathe and remove end yoke fixture assembled in operation A-2 and replace the sleeve and fittings that were removed in operation A-1. If the tube is damaged or bent beyond straightening, replace with a new tube.

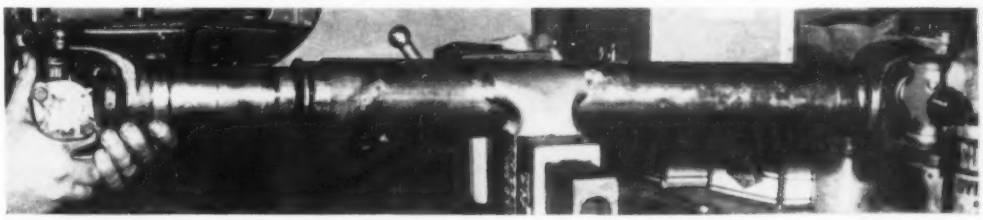


Fig. 14. Pressing tube shaft into tube, up to the shoulder.

STRAIGHTENING TWO-BALL SHAFT

(Applies to any size Spicer, Blood, Cleveland, Detroit and Mechanics cross type joints.)

Check all parts for wear and operating condition.

B-1. Remove all end fittings from assembly to be straightened.

B-2. From shop tools, select proper end yoke and assemble to shaft at the stub ball yoke end with shop set of journal and bearings (Fig. 4).

B-3. Put collet adapter tool in the lathe chuck and center for trueness.

B-4. Place the assembly into the lathe. The end yoke fixture that has been assembled to the shaft goes into the collet in the chuck. Then tighten collet cap screw.

B-5. Place steadyrest on the lathe ways as near as possible to weld farthest from the headstock, so the steadyrest will ride on the tube.

B-6. Buff the tube in three places, at both ends and at the center to obtain a clean surface for indicating run-out.

B-7. Place the table indicator on the lathe ways and indicate the tube as near as possible to the steadyrest to obtain a near zero reading .003".

B-8. Move the table indicator to the opposite end at the headstock and indicate for run-out. The total run-out should be within .005" at the weld.

B-9. Move the table indicator to the middle of the tube and check for run-out. This should be within .020" total.

B-10. While the assembly is in the lathe, mark the high spots on the tubing with a piece of chalk.

a. Turn the assembly so the high side, or side marked with chalk, is on the underside.

b. Place a steel plate, cut to fit, between the lathe ways to form a shelf.

c. Place a small hydraulic jack on the shelf so the jack ram contacts the tube at the marked area at the point of weld. Now put a slight pressure on the shaft from this position.

d. Indicate again, at headstock end and repeat until .005" limit is obtained.

e. Check the center of the shaft. If the limit of .020" has not been reached, mark the high side with a piece of chalk.

f. Remove the assembly from the lathe and place in "V" blocks on the table of the small hydraulic press.

g. Turn the assembly so the high side is facing up to meet the press ram coming down and apply slight pressure at the high point.

h. Place the assembly back in the lathe and check run-out as in operation B-10e. Repeat operations B-10f through B-10g until the assembly is within the limits.

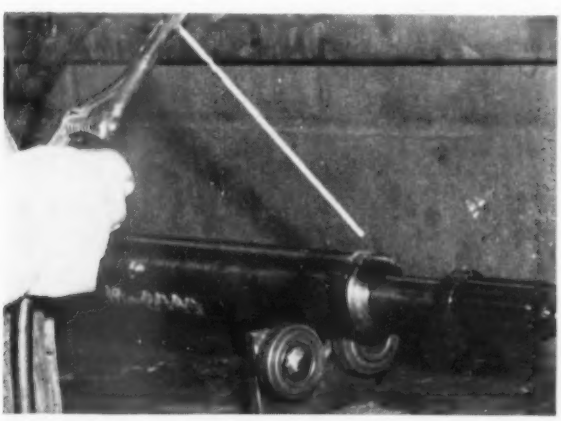
B-11. Remove the shaft from the lathe and disassemble the end yoke fixture and shop journal and bearing kit previously assembled in operation B-2.

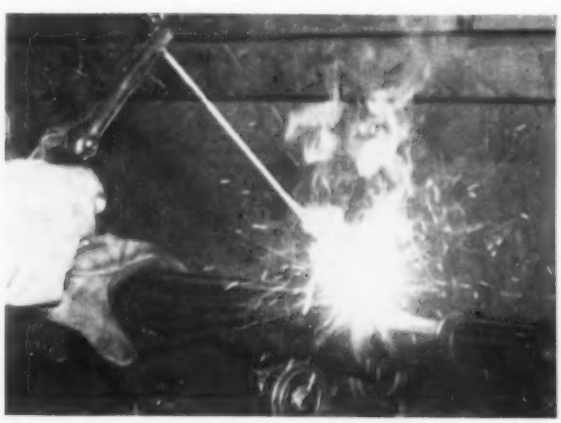
B-12. Reassemble the end yoke fixture, of operation B-11, to opposite end of the shaft and follow previously described operations B-4 through B-10h, omitting only the buffing called for in operation B-6.

B-13. Remove shaft from the lathe.

B-14. Disassemble the end yoke fix-

(Continued on following page)





Figs. 15-16. After propeller shaft is removed from the lathe it is placed in V-blocks on a welding table and tack welded in four evenly spaced points around the tube.

U-Joints . . . CONTINUED

ture and shop journal and bearing kit, which were assembled in operation B-12.

B-15. Replace the end fittings in operation B-2, replacing worn parts when necessary.

STRAIGHTENING DRIVE SHAFT (Ball Type)

Check all parts for wear and operating condition.

C-1. Remove the housing, pins and all end fittings.

C-2. Put the collet adapter tool in the lathe and center for trueness.

a. Put the female taper in the collet.

b. Put the female taper in the tailstock.

C-3. Push the assembly into the lathe, either direction.

C-4. Push up the tail stock to center assembly between the two female tapers.

C-5. Tighten the collet cap screw.

C-6. Buff the tube in three places to obtain a clean surface for indicating run-out. (Each end and center of the tube.)

C-7. Use the table indicator on the lathe bed and indicate at the buffed areas (Fig. 5). The total run-out should be within .005" at each end and a maximum of .020" at the center of the tube.

C-8. If the runout exceeds the tolerances straighten within the limits, B-10.

C-9. While the assembly is in the lathe, mark the high spots on the tubing with a piece of chalk.

a. Turn the assembly so that the high side or side marked with chalk is on the underside.

b. Place a steel plate, cut to fit, between the lathe ways to form a shelf.

c. Place a small hydraulic jack on the shelf so the jack ram contacts the tube at the marked area at the point of weld. Now put a slight pressure on the shaft from this position.

d. Repeat this operation at the opposite end and indicate again for run-out.

e. If the ends are running true and the center is still beyond the limits, mark the high area with a piece of chalk.

f. Remove the assembly from the lathe and place in V-blocks on the table of a small hydraulic press.

g. Turn the assembly so the high side is facing up to meet the press ram coming down and apply a slight pressure at the high point.

h. If the shaft is not within the limits, repeat the operations B-10f and B-10g until the assembly is within the limits.

C-10. Remove from the lathe and reassemble end fittings removed in operation C-1, replacing worn parts with new. If the tube is damaged or bent beyond straightening, replace with a new tube.

REPLACING STUB SHAFT

(Applies to Spicer, Blood, Cleveland, Detroit, Mechanics cross assemblies.)

Check all parts for wear and operating condition.

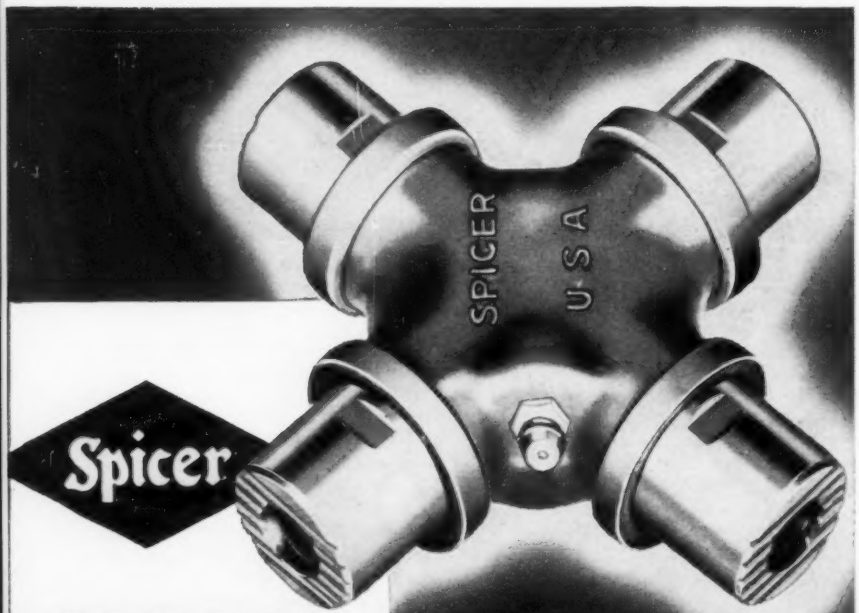
D-1. Remove sleeve yoke from the assembly to be straightened.

D-2. From the shop tools, select the proper end yoke and assemble to the shaft at the stub ball yoke end with shop set of journal and bearings (Fig. 4).

D-3. Put the collet adapter tool in the lathe chuck and center for trueness.

D-4. Place the assembly into the lathe. The end yoke fixture that has been assembled to the shaft goes into the collet in the chuck.

D-5. Push up the tail stock to center in the stub shaft. If the stub shaft is bent, broken or chipped on the end, it will then be necessary to use a steadyrest on the lathe to cut out the old stub shaft.



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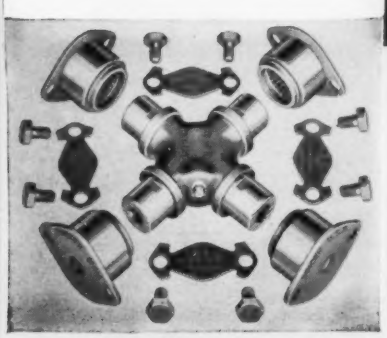

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D-6. Buff the tube in three places (both ends and center to obtain a clean surface for indicating run-out. This will be needed as the assembly progresses).

D-7. Cut out the stub shaft at the point of weld by turning off old weld flush with the tube diameter.

a. Make a "V" cut in the tube at the point of weld to depth of tube thickness or approximately 1/16" (Fig. 10).

D-8. Remove the assembly from the lathe.

a. With a steel block on the bench, place cut section of the stub shaft end of the assembly on the block and strike the tube with a brass hammer while rotating the assembly (Fig. 11). This will expand the tube to permit easier removal of the stub shaft.

D-9. After removal of the old stub shaft, place the assembly in the vise. **Caution:** Do not apply excess pressure in the vise as the tubing could be damaged.

D-10. Use a rotary file, in ¼" drill, and remove flash from inside the tube (Fig. 12).

D-11. Heat the end of the tube with a torch to a dark red. This will expand the tubing and allow for easy assembling (Fig. 13).

D-12. Install the end yoke or sleeve to the stub shaft and hand press the stub shaft into the end of the tube. Line up the lugs of the yokes at both ends of the tube so they will be in the same plane (Fig. 14). Press the stub shaft into the tube up to the shoulder of the stub shaft.

D-13. After allowing to cool for about two minutes remove end yoke or sleeve from the stub shaft and dip the heated end into water for complete cooling.

D-14. Place the assembly back in the lathe and indicate at buffed areas a reading of .005" at both ends and .020" in the center of the tube.

a. If the shaft is not running true, mark the high side with chalk and strike this area lightly with a brass hammer. Repeat until the shaft runs within limits.

D-15. Remove shaft from the lathe and place in two "V" blocks on the welding table and tackweld in four evenly spaced points around the tube (Fig. 15-16).

D-16. Put the assembly back in the lathe again and indicate to be sure the limits are still held.

D-17. After welding, check shaft for run-out and straighten by hydraulic jack method outlined in "Straightening Drive Shaft" (Cross Type). (See Operation A-10.)

D-18. Remove to welding bench and complete weld around the flute (Fig. 15-16).

D-19. After welding, check the shaft for run-out and straighten by hydraulic jack method outlined under "Straightening Drive Shaft" (Cross Type). (See Operation A-10.)

D-20. Remove end yoke fixture assembled in operation D-2. Then, reassemble sleeve yoke. Welding can also be done in the lathe, but cover ways of lathe for protection from welding arc.

Fig. 17. Stub ball yoke removed from tube.

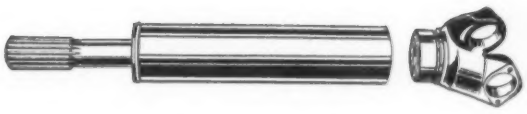
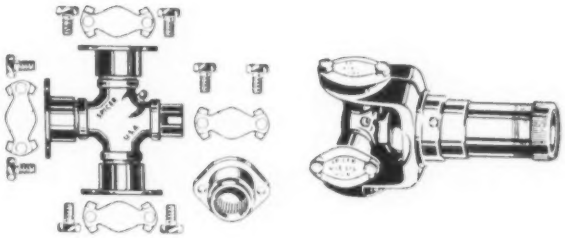


Fig. 18. Stub shaft and sleeve yoke removed from assembly.



REPLACING STUB BALL YOKE

(Applies to any size Spicer, Blood, Cleveland, Detroit and Mechanics cross type.)

Check all parts for wear and operating conditions.

E-1. Remove sleeve yoke from assembly if assembled with stub shaft (Fig. 18).

E-2. Remove any fittings from the stub ball yoke end including journal and bearing kit.

E-3. Place steadyrest on the lathe bed.

E-4. Put the assembly in the lathe with stub shaft end at chuck.

E-5. Chuck stub shaft on the neck behind the spline.

E-6. Move steadyrest to about 3" from the ball end of the assembly to be cut off.

E-7. Indicate the end of the tube to a .000" to .005" reading and tighten the steadyrest.

E-8. Buff the tube in three places, both ends and center, to obtain clean surface for indicating run-out. This will be needed as the assembling progresses.

E-9. With a cut-off tool or parting tool in the lathe carriage, cut-off the weld at the yoke end flush with the tube diameter.

E-10. Take "V" cut in the tube at point of weld to depth of the tube wall thickness approximately 1/16" (Fig. 10).

E-11. Remove the assembly from the lathe, place steel block on the bench and put the assembly at the cut end on the block and strike around the tube at this area with a brass hammer (Fig. 11). This will expand the tube so the ball yoke can be easily removed.

E-12. After removing the ball yoke place the tube assembly in the vise and use a rotary file tool in the electric drill and remove the flash from inside of the tube (Fig. 12).

E-13. Heat the end of the tube with a torch to a dark red; this will expand the tube and allow for easy assembly of the ball yoke (Fig. 13).

E-14. From the shop tools, select the proper end yoke and assemble to the shaft at the stub ball yoke end with a shop set of journal and bearings (Fig. 18).

E-15. Assemble the sleeve or end yoke to the stub shaft end for aligning purposes.

E-16. Press the ball yoke in heated end of the tube, lining up the lugs with the other end of the shaft so both ends will be on the same plane (Fig. 14).

E-17. Remove the sleeve yoke from the slip end assembled to operation E-15.

E-18. Place the assembly in the lathe and indicate at the buffed areas to a reading of .005" at both ends and .020" in the center of the tube.

E-19. If shaft is not running true, mark the high side with chalk and strike this area with a brass hammer. Repeat until the shaft runs within the limits.

E-20. Remove the shaft from the lathe and place in two "V" blocks on a welding table and tack the weld in four even points around the tube (Fig. 15-16). (This operation can also be done with the assembly still in the lathe.)

E-21. Put the assembly back in the lathe and indicate again to be sure the run-out limits are still held.

(Continued on page 74)

New Rambler American has 100" wheel base

• ECONOMY AND HANDLING ease comparable to small European cars; performance, comfort and roominess of the large American cars—that is the claim of American Motors for their latest entry, the five-passenger, two-door Rambler American.

Powering this 100" wheelbase line is a 90 h.p., L-head six-cylinder engine with a compression ratio of 8:1 and a piston displacement of 195.6 cu. in. Bore and stroke are 3⅛"x4¼".

With overdrive and favorable driving conditions, the manufacturer claims it is possible to obtain up to 35 m.p.g. with regular grade gasoline.

A 3-speed manual transmission is standard equipment on the Rambler American, although a Borg Warner Flash-O-Matic transmission is available at extra cost.

SIMPLICITY OF DESIGN

Simplicity and practicability keynote the styling both inside and out to give a "clean, functional" appearance.

Front fenders rise above the low hood, resulting in excellent visibility for the driver and passengers. To further aid visibility, window posts are narrower, and the larger rear window measures 700 sq. in. Total glass area is 2,615 sq. in.

The finely meshed oval grille of anodized aluminum is framed with a chrome-plated zinc die casting, and designed to give an uncluttered front-end appearance. In addition, the American boasts such American Motors features as reclining seats, all-welded single unit construction, "body-dip" rust preventative, the Weather-Eye heating and ventilating system, and others.

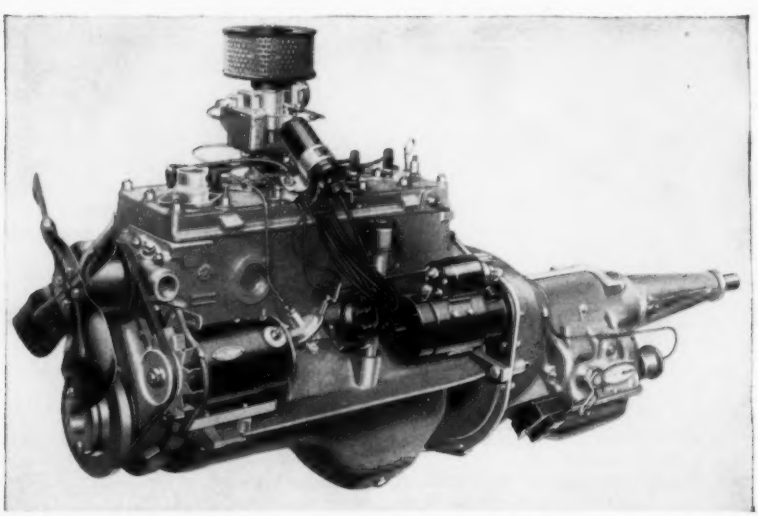
The new car is roomy, offering 58" of front-seat hiproom and 45¼" of rearseat hiproom. Legroom dimensions are 44" in the front and 37½" in the rear—which is said to give adequate comfort for five passengers.

The American will be available in nine solid colors and eight two-tone combinations. On two-tone models the secondary color is used on the roof panel. Double-coat baked enamel is used.

Interiors are color-keyed to the exterior finish. Upholsteries are of nylon-blend fabrics with vinyl trims. Also, all-vinyl upholstery is offered at no extra cost.

As a further aid to economy of operation for "do-it-yourself" fans, each American purchaser is provided with a manual which shows how to make general repairs and adjustments which do not require special tools or equipment. The manual outlines adjustment and repair procedures for items such as the carburetor, distributor, wheel bearings, brakes, ignition and spark plugs, as well as showing how to lubricate the car.

The new Rambler American is a two-door, five-passenger sedan, built on a 100" wheelbase. It is the only small car available with an automatic transmission, as well as standard synchromesh and optional overdrive.



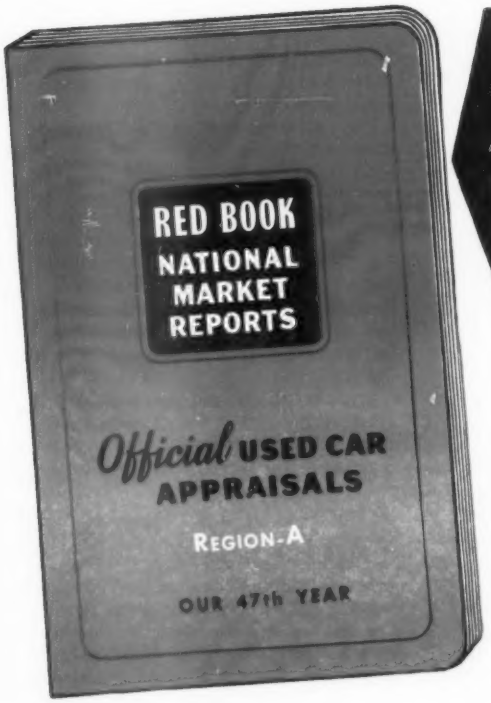
Power plant is a six-cylinder L-head engine developing 90 hp. It has a compression ratio of 8:1 and a piston displacement of 195.6 cu. in. Bore and stroke are 3⅛"x4¼". It is equipped with a single barrel carburetor.

Give Your Customers A Book on Safety

Looking for a "good will" item to give to your customers? How about a copy of "How to Test Your Driving Skills", a booklet available from Employee Relations, Inc., 13 East 53rd St., New York 22, N.Y.

This booklet is available under any company's own imprint and is said to have created considerable interest among safety people because it does such a fine job of educating drivers in the reading of road signs and in testing reactions.

Say You Saw It In
Automotive Service Digest



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AD

Here's the "hole" answer when . . .

By C. P. EDWARDS

Your reputation hangs by a thread

• A STRIPPED OR CROSS threaded spark plug hole, or a head bolt that *almost* holds, can give your profit and reputation a rough time. So can an oil pan or timing cover bolt give you a few extra gray hairs when it suddenly "decides" to turn *easier* as you are tightening it to stop an oil leak.

The "hole" problem in every case is that you have a damaged thread. And while there are many ingenious, though time-consuming ways of licking this problem, nothing to date seems better than the use of a stainless steel wire thread insert.

To see how really simple and effective the use of inserts is in repairing damaged threads, look in on R. R. Blosser, owner of the ABC Parts and Machine Co., Rockford, Ill. Blosser meets a wide variety of stripped and crossed threads. This is but natural, since he rebuilds engines of all kinds, including power lawnmowers and motor cycle engines.

RENEWING SPARK PLUG THREADS

Blosser's method of renewing a spark plug hole thread is a little different from renewing the thread in a hard steel part. Since the head is of cast iron or aluminum, Blosser, as we see in Fig. 1, merely uses a centering fixture to align the oversize tap that cuts away the material and makes the new thread for the insert.

The stainless steel inserts, which look like little coil springs (Fig. 2) are installed with the special tool which we see Blosser using in Fig. 3.

Actually the insert goes slightly undersize as it is wound into place, but when released from the inserting tool it expands to a snug fit in the newly cut thread. The tang that is used for screwing the insert into place is broken off at a notch after the insert is seated.

An idea of the permanence of this type of thread repair is seen in the fact that while Blosser has used these stainless steel wire thread inserts for over 8 years, *not one has failed him in service.*

IT PAYS TO RETHREAD ALL HOLES

It should have been pointed out that whereas in a cylinder head there may be but one hole that is actually stripped or crossed, that Blosser finds it good business to install inserts in all 6 or 8 holes. Actually once the job is set up with tools at hand, it only takes a few minutes more to fix all of the threads.

Blosser has what it takes to repair practically any thread in an automobile engine. But when it comes to renewing the threads in the bearing web, Blosser does drill out the steel block so that the special insert tap has an easier time of cutting the correct thread for the insert (see Fig. 4).

Fig. 1. First step in repairing a damaged spark plug thread is tapping new threads with a Heli-Coil tap. A centering fixture bolted to the head assures straight threads.

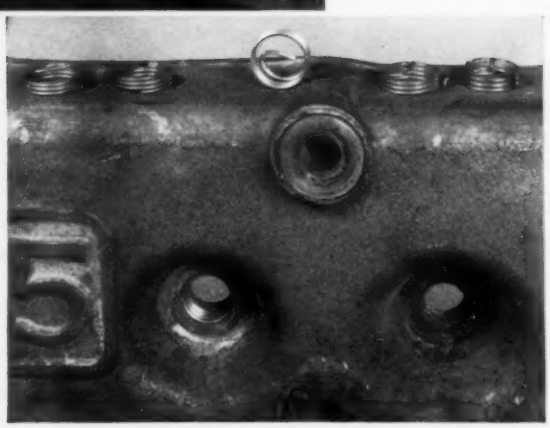

Fig. 2. What the inserts look like before installation. The tang of the insert that crosses through the center breaks off at a notch after the insert is seated.

THREADS BETTER THAN NEW

Not all Blosser's job are big ones, some are little. And they would be "ornery" except for a good stock of thread inserts in all sizes. Note, for example, the little fellows in the foreground of the engine in Fig. 5. Here Blosser is making the threads in this single-cylinder engine far stronger than new by the insert method. He emphasizes that the increasing use of aluminum in cars is making it more and more important for mechanics to have at hand the means of repairing stripped threads without too much loss of time and material, and without too great expense to the customer.

And if aluminum is gaining in popularity in automobiles, it is even more popular in the marine engine industry —especially in the outboard field. And it takes no statistics to prove that this activity is growing by leaps and bounds. Never before has so much aluminum and magnesium been used in outboards as is now the case.

THREADS IN LIGHTWEIGHT METALS

To keep these engines portable despite their increasing size, aluminum

and magnesium fill a vital role. And one does not have to have had much experience with these metals to know that getting a little too strong on the wrench can really mess up the threads (Fig. 6). Many a boat owner in performing some of his own service operations has contributed to the number of worn, damaged, or stripped threads in aluminum parts.

But a fellow like Bert Clear, owner of Lake Marine Base at Candlewood Lake, Conn., has the answer—the precision formed stainless steel wire thread reliners.

THREADS RUINED BY CORROSION

And in boat work this type of thread repair with a stainless steel reliner is particularly important. As a matter of fact, not only do marine engines have the problem of holding high stressed parts in relatively soft aluminum and magnesium but they face serious corrosion, particularly in inboard engines, which are constantly kept on the water. Often in overhauling an inboard engine, damaged threads are found as a result of corrosion alone.

It is common knowledge that many marine parts are relatively scarce or rather costly. So many a boater is happy to find that Bert Clear has what it takes to repair almost any damaged thread. without extensive tearing down, welding, drilling, and rebuilding, or returning of the part to the factory. Instead Bert uses the "3-step" method of thread repair. He drills out the damaged threads, taps a new thread for the insert, with a special oversize tap, and winds the insert into place. And what is more important in boat work, the stainless steel insert proves more permanent than the original, since it has high resistance to future wear, stripping, corrosion, seizing, or galling.

One of the most troublesome spots for thread damage found by Clear's mechanics has been the small aluminum tabs that are used to locate cowlings around the engine. These cowlings are frequently taken off and put back on by the boat owner. The screws are usually taken out in a hurry and put in in a hurry so that crossed threads and stripping is not uncommon.

As a matter of preventive maintenance, Clear often renews these threads with the use of stainless steel inserts when an engine is first brought in for service (see Fig. 7).

AVAILABLE IN KIT FORM

These stainless steel inserts are made by the Heli-Coil Corp. of Danbury, Conn., and are generally available in special kits at automotive

(Continued on page 78)

Fig. 3. Using inserting tool to run in a 14 mm. stainless steel insert.

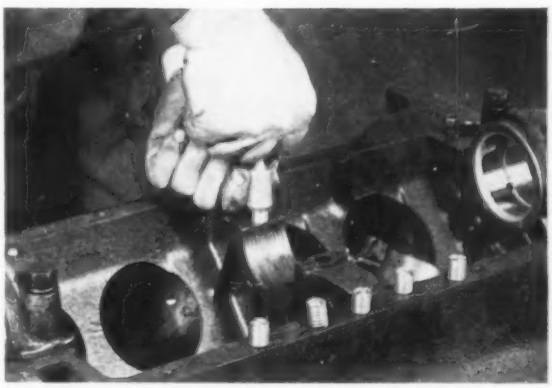

Fig. 4. Unlike a direct tapping of a spark plug hole, this block center bearing web was drilled before tapping for inserts.

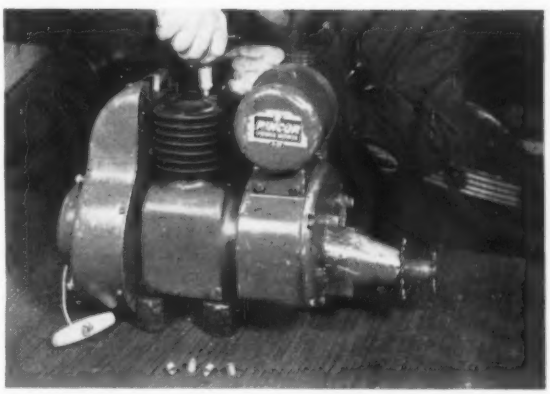

Fig. 5. The threads in this single cylinder air-cooled engine block will be better than new when the inserts in the foreground are installed.

Fig. 6. A vulnerable spot in the aluminum head of the modern outboard is the spark plug hole. Fortunately stainless steel wire inserts can repair stripped threads quickly and at small cost.

By STOKES TAX CONTROLS, INC.

Tax guide and business briefs

√ *Where to in 1958*

• IN THE AUTOMOTIVE industry, there doesn't seem to be any reason to believe that 1958 profits will be better or worse than 1957. You will probably sell more shop labor and merchandise at a smaller margin. Those who make more money in 1958 are those who profit by 1957 experiences and increase efficiency with labor-saving equipment and improved shop practices.

You are in a fast, tough, competitive business. You need a map to show where you have been and where you are going if you want to end 1958 with a decent profit.

ATTEND TO PAPER WORK

You are a businessman and a salesman and an optimist or you would not be in business. Many businessmen live from day to day fighting each day's problems until the cancer of discouragement gets them down. Forecasts and financial statements and paper work are for the big boys. The big boys got that way because they attended to those things.

The train from New York to Chicago runs on a detailed time table. Imagine the situation if the railroad superintendent said, "We cannot forecast arrival time because we may hit snow, equipment failure, or wrecks; we will do our very best to get there as soon as possible." A businessman without a forecast is in that position.

COMPARE FINANCIAL REPORTS

You don't have to be an accountant to make a forecast so long as you understand your financial statements. A logical approach to a forecast is to take your annual profit and loss statements for the last three years and lay them side by side.

First you will estimate what you will sell. Don't forecast on the assumption of a change in general business conditions. Have specific reasons why this year will be different. If there is someone else in your organization who participates in sales, get their ideas on how a better job can be done in 1958.

SET UP A DAILY QUOTA

Possibly make your preliminary estimates based on 1957 adjusted for known changes in conditions such as improved products, time-saving equipment, new lines taken on, etc. If more volume is forecast by necessity, make specific plans how it is to be obtained. Break down your annual quota by months and then set up a daily quota. Many days the quota will not be made but you do have a target. When you get up in the morning, you think about today's problems and maybe tomorrow's. You think about what you have to do today to make up for yesterday's slowdown. Daily quotas are most important.

Your editor drives over 2,000 miles per month. Not twice a year does a service man suggest a new oil filter or wiper blades, point out a bad fan belt or what have you. What a golden opportunity to sell is being lost!

CHECK THAT PAYROLL

Payroll takes a big share of the profits. Are all the people pulling their share of the load? If you have an old faithful employee who is no longer competent, it may be cheaper to pension him or dismiss him with a substantial bonus. Such payments are tax deductible. Consider incentive plans to get more work. Use only tried and tested plans and keep your compensation plans simple so that all concerned can figure it quickly. Good faithful employees expect merit increases because they have completed another year of service and this factor should be included in your cost estimates for 1958.

Examine your 1957 advertising for service revenue as to cost and effectiveness. Eliminate the "gadget" advertising. Don't be a sucker for advertising in every community program and school paper. Probably you have to buy them all or refuse them all. Consider whether more direct mail will hit the customer target more effectively.

SOLICIT BUSINESS BY TELEPHONE

Evening telephone solicitation is tedious, but it gets results. Suppose you could get each employee to bring in a neighbor's car for service in the morning and bring it back to him at night. This potential has never been fully exploited. Set up incentives to get employees to make telephone solicitations at night. Students or people employed elsewhere can be hired for night work. The proper amount to be spent for advertising varies in each locality. Do make sure that your advertising produces results.

Check your bills for laundry to eliminate waste. If employees operate company cars on personal business, budget the gasoline. You will probably find that all gas tanks are being filled on Saturday afternoon.

Use purchase orders approved by you or your delegate before purchase. Insist that the price be on the purchase order. Did you ever buy a suit or a pair of shoes without asking the price?

KEEP TRACK OF "SMALL" ITEMS

Control miscellaneous supplies. Make sure that personnel are not supplying their home garage with chamois, cleaning compound, bolts, cotter pins, polish, etc. You can put the use of these things on a daily quota. If you have open parts display, check your pilferage losses.

Tag the lights with a reminder to extinguish them when not in use. Eliminate personal use of telephones. If there is a switchboard, the operator can control this. Otherwise relocation of telephones may be necessary.

If you have a night operation, be sure you know what goes on. The night man may be operating his own little repair business on your time.

Lastly, don't cut expenses that will adversely affect revenue, but do budget your expenses on a daily basis. If you once get this system rolling, your people will find that it doesn't take any more time to do it right. You will be well on the road towards more profit in 1958.

Plugs Not Always to Blame When Engine Misfires

When we think of a cylinder misfiring, we usually think of a fouled spark plug, but the cause is often a result of factors other than spark plugs. Actually, *misfire means the failure to ignite the fuel charge.* Obviously, a combustible mixture must be present in the cylinder to fire, and it must have a spark of sufficient intensity to be ignited.

The primary job of the spark plug is to transfer the ignition system energy into the cylinder in the form of an adequate spark. If the fuel charge is normal, and fails to ignite, you can pinpoint your trouble at the plug. The next step is to find out why the spark plug is not firing normally. Often you hear the expression the plug "breaks down"; what really happens is one of six possible conditions:

1. The spark plug gap may be so small that there's insufficient combustible mixture between the electrodes.
2. The gap may be so wide that the ignition system is unable to supply enough voltage to jump the gap.
3. The gap can be bridged by some conducting deposit which prevents a normal spark plug discharge.
4. The high voltage can short over the exterior of the plug—this is called "flashover".
5. The high voltage can leak to the ground through a direct mechanical break in the insulator.
6. The high voltage can leak to the ground through conductive deposits on the firing surface of the insulator. In this case energy is drained away and the ignition system cannot build up sufficient voltage to jump the gap.

Of the conditions illustrated here, the fouled plug is by far the most common source of misfiring trouble. When the conductive deposits are removed, either by cleaning or by burning them off at higher speeds, the spark plugs firing ability is largely restored.

Modern V-8 engines, which use so little of their power at normal operating speeds, often won't show a misfiring condition except under extreme loads. The driver only notices a slow decrease in performance and economy, seldom realizing that one or more plugs may be misfiring.

According to surveys conducted by Champion Spark Plug Co., a great majority of the cars on the road today have one or more cylinders misfiring erratically—usually due to dirty or worn-out spark plugs.

Putting your spark plug tester to work can help you to sell some of the millions of spark plugs which are so badly needed—as well as turn up other work needed to give car owners top engine performance and economy.

Volkswagen Convertible To Appear Later This Year

Following on the success of the Volkswagen Karmann-Ghia-Coupe, a new Karmann-Ghia Convertible will appear on the market the latter part of '58 in limited quantity.

Designed by Ghia in Turin and utilizing the VW chassis and engine, the new convertible introduces a soundproof folding top with large dimension rear window set low for extra visibility. Like the Coupe, the Convertible is said to have exceptional road holding qualities as well as cruising and maximum speed of 72 mph.

Standard equipment will include light signal, two spoke steering wheel with horn ring, fuel gauge positioned between speedometer and electric clock and sun visors. Numerous color combination in a wide range of colors will be offered.

Say You Saw It In
Automotive Service Digest

FROM ENGLAND . . . by DEMAND

CUSHIONED RIDE

ARMSTRONG

SHOCK ABSORBERS

are now available to American car owners for an entirely new concept in quality riding—safest comfort and smoothest performance at all speeds.

It's the exclusive "circulating oil" design that makes the big difference . . . that's why Armstrong is standard equipment on 80% of British built cars, and continental cars too.

Remember, all shocks are not the same, some run hot and cause oil to thin out for decreased shock action at high speeds and on rough roads. But with Armstrong Cushioned Ride Shocks, less heat builds up—oil maintains its body and you get a shock action that is steady at all loads, roads and speeds.

So sell "the ride of your life," sell the quality shock absorber—ARMSTRONG. Millions in service. No more in price. Armstrong offers the most complete line of shock absorbers in the world—chosen as original equipment by more automobile makers than any other.

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Armstrong offers jobbers greater sales and profits with the world's most complete line. American, British, European cars, trucks, buses and motorcycles . . . plus a QUALITY never before seen in this country.

Write for complete details on this outstanding shock absorber at a competitive price for greater demand—greater profits for you.

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These are new *manufacturers' products*

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DuMont Unveils IgnitionScope

To enable the smaller repair shops to cash in on engine analysis by use of the oscilloscope, Allen B. DuMont Laboratories, Inc., has unveiled a newly designed IgnitionScope that is less expensive than its EnginScope

due to the fact that use of the new unit is restricted entirely to ignition analysis.

The new instrument features DuMont's multiple line presentation and Signal-Clip technique. The signal clips pick up the engine "pulls" through induction, thereby eliminating the need of disturbing the automotive system or piercing the ignition wires.

According to the manufacturer, the multi-line or raster presentation allows a mechanic to pinpoint troubles in the ignition system by cylinder comparison. Each cylinder operation, from the firing of the spark to the points open condition, is shown on the instrument's picture screen, one line directly below the other, in the exact firing order of the engine.

By viewing the electronic light patterns on the IgnitionScope's tv-like screen, the mechanic pinpoints instantaneously a wide variety of ignition troubles including fouled, misfiring, open, or shorted spark plugs; defective coils, condensers, wiring and switches; worn distributor cam and shaft bearings and burned distributor points.

(Use Reply Card for Further Information)

Pistol Grip Air Impactool

A new small size pneumatic Impactool, with built-in air regulator is announced by Ingersoll-Rand for such automotive service jobs as body work, automatic transmissions, instrument

panel, heaters, air-conditioning and accessories.

The new tool, known as the Size 402 Select Air Impactool, is said to be the smallest pistol grip power wrench on the market—its overall length is only 5 13/16" and its weight 4½ lbs. Because of its small size and light weight, it is believed that mechanics will find it useful for close quarter work and for reaching areas hitherto inaccessible to power tools.

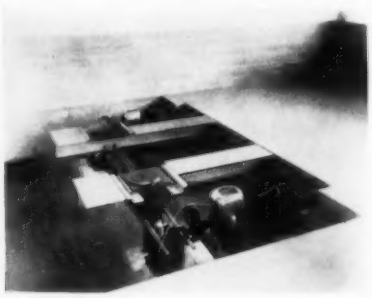
The built-in power regulator on the tool is calibrated to permit the operator to adjust the air flow as desired and select the power needed for the job. Additional features are a trigger control which can be operated with one finger, a natural-grip handle, easy to operate reverse valve and a rubber nose to seal out dirt and keep the Multi-Vane air motor clean.

The ⅜" square drive tool has a side-to-center distance of 1⅜", and has a ¼" hose connection pipe tap. Its average air consumption is 2½ cu.ft.

(Use Reply Card for Further Information)

Adjustable Wheel Aligner

A new pit-type wheel aligner is announced by John Bean Division that accommodates a 48" to 90" tread width; thus making it possible to align wheels on trucks, buses, passenger cars, foreign cars and sports cars,



with only one unit. The aligner may be used with portable equipment, mechanical or Visualiner heads.

A "tip-back" feature allows the heads to be dropped out of the way of the operator, permitting easy accessibility and convenience in working around the front of the car, and roller-bearing mountings permit them to slide easily and advantageously.

The runways are also mounted on roller bearings making tread adjustment easy and effortless. Front axle work can be handled on this heavy-duty runway and center beam. On each runway is a self-centering, heavy-duty turntable that adds to convenience of operation.

(Use Reply Card for Further Information)

Proto Wire Stripper

This new wire stripping tool (No. 299), recently announced by Proto Tool Co., is only 5″ long and features a thumb-operated gauge which can

quickly be set to strip all commonly used insulated wire from 14 to 24 gauge without nicking or cutting. "Handeze" plastic grips lessen fatigue and increase user comfort, and, according to the manufacturer, streamlined design permits work in tight places.

(Use Reply Card for Further Information)

Tap and Die Hexsets

Rinck-McIlwaine announces a new combination tap and die Hexset for the special needs of the auto mechanic. It both cuts new threads and serves as a rethreader for rethreading worn or mashed threads whenever they are in close quarters.

The set consists of 17 taps and 17 hex dies, 2 die stocks, 3 tap wrenches

and a thread gauge. It takes all fractional sizes from ¼″ to ½″ in both coarse and fine threads and six machine screw sizes. A feature is a special T-handle tap wrench with removable handle and a ⅜″ square opening to be used with extension wrenches. The box is maroon polyethylene plastic, very tough and durable, but light in weight.

(Use Reply Card for Further Information)

New "Jenolizing" Process

A brand new reconditioning process, called jenolizing which is said to make automobile engines look like new, protect them against rust, and reduce the risk of serious engine fires, has been announced by the Homestead Valve Mfg. Co.

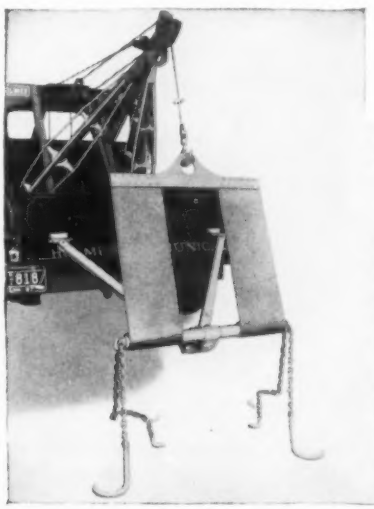
Two new developments of the Company's Hypressure Jenny Steam Cleaner Division are important to the Jenolizing Process. The first is a new cleaning compound, known as "AP," which can be used without harm to paint, wiring, or aluminum and magnesium surfaces. Second, is a protective coating, called Protect-O-Gloss, which is applied while the steam cleaned surfaces are still warm and wet. Protect-O-Gloss is said to prevent rust and leave a glossy, like new finish on all surfaces.

The company offers a complete kit of Jenolizing materials and merchandising helps for those who have Jenny steam cleaners and want to Jenolize for profit. For those without a steam cleaner, they offer a choice of two Jenny steam cleaners, either of which can be made to repay its cost from extra profits in less than two months.

(Use Reply Card for Further Information)

Holmes Tow Sling Offers Cushioned Safety

After considerable research and study on how to provide a safer means of handling the 1958 cars with their low body styling and air suspension systems, without damaging chromed and painted surfaces, engineers of the Ernest Holmes Co. came up with an entirely new principle of lifting and towing, which many of the automobile manufacturers have approved and recommended for the safe handling of



their '58 models. This is made possible by the suspension of two high strength, fabric lifting straps that provide a new type of cushioned safety. The bumper and bumper guards cannot be scarred, bent or defaced, due to the fact that no metal comes in contact with these parts.

The Towing Sling has a rated capacity of 3,000 lbs., which is ample for lifting either front or rear end of any of today's automobiles. The design of this towing device with its spacer bars, lifting straps and towing hooks affords a very fast method of pick-up, and the initial positioning of the tow truck to disabled car is not critical, so that the average hook-up can be made with considerable speed.

Once the wrecker is in position, all the operator has to do is attach the large shank hook on each chain to either the axle, spring hanger or lower suspension arm. The fabric straps are then placed about 6″ under the end of the car, extending self-adjustable telescopic spacer bars to that point. The hook chains are tightened and fastened in the grab hooks at each end of anchor bar. The car is then ready for lifting by the wrecker, and, when raised, moves to a fixed point on the spacer bars where plunger pins automatically snap into locked position.

The belt-like straps readily conform to various contours which spreads the

lifting load over a large area so as not to damage light grilles or panels.

The telescopic, "V" type spacer bar assembly, which is bolted to the tail gate of the wrecker body, is designed to rigidly hold the car in a fixed position, free from swaying or jamming into the tow truck. When in-tow, the car has a sharp turning radius and may be backed into close places with the same ease as a trailer.

The Towing Sling is easy to install and can be used efficiently on most any type of wrecker. The sling assembly is permanently attached to the spacer bars in towing position, always ready for quick use. When not in use, sling assembly may be folded against the tail gate and held in place by the support chains.

(Use Reply Card for Further Information)

These are new *manufacturers' products*

Spark Plug Cleaner and Tester

Champion Spark Plug Co.'s new Series 800 spark plug cleaner and tester has a new spark indicator rather than the old comparator type tester. Previous models required the operator to compare a new spark plug with the

old one being tested. However, with the new indicator direct readings can be obtained from the spark plug being tested. The indicator provides a faster and more accurate method for testing used spark plugs.

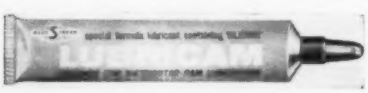
Another improvement is an abrasive bag which automatically sifts out all of the worn abrasive dust. In addition to this new bag, an automatic water trap to remove moisture from the abrasive has been included as standard equipment. The water trap was formerly available only as an accessory item. Coil and transformer are contained in one sealed electrical unit.

Other new features include a more accessible spark switch button, a streamlined cabinet, and a plug adapter to fit the three pronged power supply cord which incorporates a ground contact.

(Use Reply Card for Further Information)

Blue Streak Lubricam

Lubricam SL-2, recently announced by Standard Motor Products, Inc., is made from a special scientific formula containing Silicone, and is said to be the ideal lubricant for distributor cam lubrication, as well as for lubri-



cation of distributor plate pivot pins and all ball bearings where high temperature operating conditions occur. In addition to lasting longer than most lubricants, the manufacturer states SL-2 will prolong the life of the rubbing block and cut down on the adjustment of contacts. It is supplied in tubes with a long nozzle which enables it to reach even the most inaccessible parts.

(Use Reply Card for Further Information)

Coil and Condenser Tester

The Graham Model 51 Coil and Condenser Tester actually comprises three testers in one: (1) magneto coil and armature, (2) battery ignition coil, (3) condenser tester for both magneto and battery systems. According to the maker, Graham Research, Inc., the model 51 was developed, designed and produced in cooperation with manufacturers whose products are to be tested. Coils, for example, are completely tested against specifications supplied through the cooperation of these manufacturers.

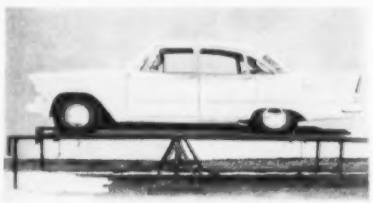
Primary and secondary windings are tested for high resistance, opens, shorts to ground and shorted turns. Operating performance, secondary leakage, polarity and excess distributed capacitance are checked while the coil is actually being fired 3600 times per minute. An accurately controlled and measured primary input generates a secondary voltage as specified by the manufacturer. The spark gap is used as a fixed load on the secondary during polarity and distributed capacitance tests.

Condensers are tested for insulation leakage and break-down, series resistance and capacity—all with only one hook-up. Condensers are automatically discharged at completion of tests. All circuits and spark gap are individually calibrated at factory and are quickly field-checked by operator. Not necessary to "zero" between tests. Meter is a 6", high quality, heavy duty, jewelled, moving coil type and has a 500 micro-amp movement, shunted to provide damping for instant, accurate readings. Operates on 110 volt, 60 cycle, A.C. current.

(Use Reply Card for Further Information)

Portable Auto Ramp

Bil-Jax, Inc., announces a new portable auto ramp that requires no hydraulic or power mechanism. Known as "Rampa," the all-steel unit is adjustable to varying degrees of tilt, and



to varying car tread widths. Once a car is driven onto the ramp, the manufacturer states it may be tilted forward or backward by hand, for underneath service at either end. The ramp is said to require no special installation, and may be moved readily from one location to another.

(Use Reply Card for Further Information)

Hold-Down Kit Assortment

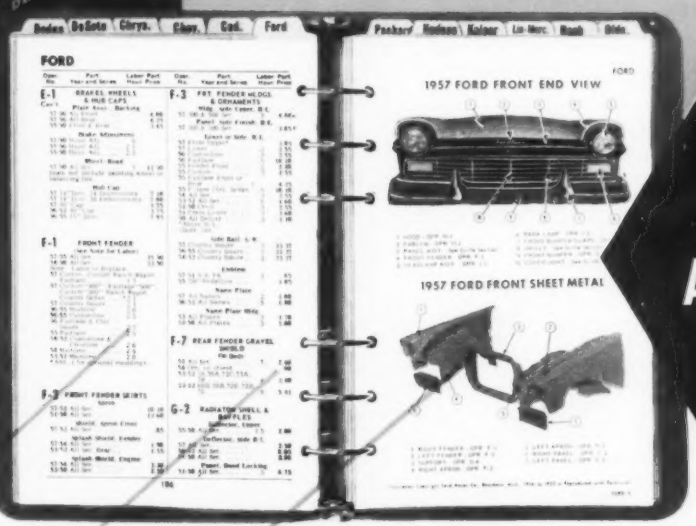
The Automotive Division of Wagner Electric Corp. announces a new assortment of brake shoe hold-down kits to help speed up brake work.

The assortment contains thirty-

eight kits of eight sizes for complete coverage of all passenger cars and trucks equipped with popular servo-type brakes. Each kit contains springs, pins and washers for one brake assembly.

(Use Reply Card for Further Information)

NATIONAL AUTO PARTS & LABOR MANUAL



Sturdy Leatherette ring binder opens flat — index tabs for each car for fast reference—4½" x 6⅝" easy-to-read pages.

assures you **SPEED ACCURACY PROFIT**

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*Official factory time studies** expressed in hours and tenths, automatically figured at your hourly rate. No arithmetic—no chance for error. Covers all domestic cars.

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Factory parts list prices for all current makes, all models for the past 8 years—hardtops, convertibles and station wagons included.

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Body Shop Operators will save time in estimating and billing when using the DeLuxe Edition. It shows exploded views of front and rear suspensions, grilles, power steering — front sheet metal, including sub-assemblies and bumper—body diagrams, indexed by make.

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With National's Manual, you never have to guess at parts or labor charges for collision, chassis, mechanical, trim, glass or body repairs. The DeLuxe Edition, for just $16.50, contains the illustrations, exploded views, etc., all the latest figures—and it is kept up-to-the-minute and complete throughout the year with a replacement-revision service that normally totals 15 mailings of more than 1300 pages annually.

A fast, easy-to-use, compact master manual

Note: COLLISION section, with operations listed in logical sequence.
CHASSIS MECHANICAL section, covers all other phases of repair services.

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So for profits on your labor and parts—for speed and accuracy in estimating every service and repair job—mail your subscription now. Your complete satisfaction is guaranteed.

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AD

These are new *manufacturers' products*

Power Timing Light

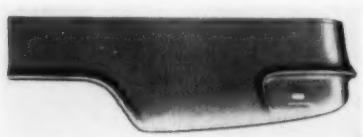
An improved AC power timing light is announced by the Herbrand Division, Bingham-Herbrand Corp., who claims the light is equipped with a totally new circuit which will stay cool even after long hours of continuous operation, and won't bake or burn out. A bright, narrow beam for pinpointing the timing mark is supplied by a long-burning xenon stroboscopic lamp.

Requiring only two connections and a 110-volt power source, the light can be used to check 6-, 12-, 24- and 48-volt and magneto equipment. The case, which was designed for use in cramped quarters, is light weight, precision-balanced and shock-proof.

(Use Reply Card for Further Information)

Chevrolet Fender Sections

As the latest addition to its more than 400 autobody repair panels, the Schofield Mfg. Co. announces the



availability of fender sections to simplify and speed up the repair of the lower rear and front fender sections on all 1955 Chevrolets.

The manufacturer states that these fender repair panels are precision die-formed and pierced—tailor made to fit exactly the part being replaced.

(Use Reply Card for Further Information)

New Multi-Purpose Lubricant

Auto-Lube "A", a new multi-purpose lubricant, developed to meet all modern automotive grease requirements in the passenger car field, has been announced by the Lubriplate Division, Fiske Brothers Refining Co.

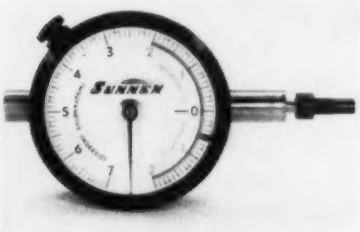
A product of three years research and field testing, Auto-Lube "A" is a general purpose, medium density, grease-type lubricant, recommended for chassis, wheelbearings, universals, and other car parts. It has high film strength, low cold test, and high melting point. It is water-proof and performs equally well in all weather, during all seasons.

(Use Reply Card for Further Information)

Indicator Dial Improved

A new improved indicator dial is now available for the present users of the Sunnen AG-300 precision clearance gauge.

The new dial is said to be much easier to use and read. Clearances are



clearly shown in green numbers on the dial face, and interference, or press fits, in red markings. A new adjustable limit marker allows the operator to pre-set tolerance limits before gauging. Zero on the dial represents actual wrist-pin size when pin-fitting, or manufacturer's size when reconditioning connecting rods.

All new Sunnen AG-300 gauges will be equipped with the new AG-50 indicator dial. Consistent with the company's previous policy, users of the AG-300 gauge may trade-in their present dial indicators for the new style at a very nominal cost.

(Use Reply Card for Further Information)

Battery Terminal Puller

A fast, easy-to-use tool that simplifies removal of corroded battery ter-

minals is announced by the Owatonna Tool Co.

Drop-forged from alloy steel and fully heat treated, this tool incorporates a striking pad which enables the operator to drive the prongs under the cable connection and center it over the terminal. A few turns with the T-handle screw is said to quickly remove the terminal connection without damage to the case. There are no jaws to adjust or apply and once the tool is located under the cable connection it cannot slip off.

(Use Reply Card for Further Information)

"Kar-Kap" Keeps Windows Clear

To eliminate the winter nuisance of scraping and sweeping car windows, Sterling Products is offering the Kar-Kap, a plastic protector for slipping over the top of the car to cover the

windows . . . preventing snow and ice from collecting on them. It is anchored in place by four elastic shock cords with rubberized hooks, which are attached to the car's fenders.

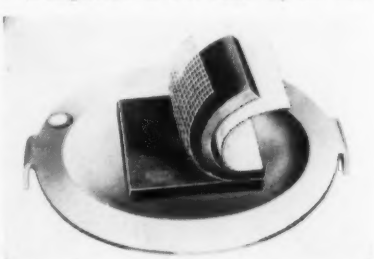
Made of heavy polyethelene plastic, it will not freeze to the windows or crack in severe cold.

(Use Reply Card for Further Information)

Nylon-Reinforced Tire Patch

A new nylon-reinforced patch for tubeless tire repairs, has been introduced by the Dill Mfg. Co.

Designated as No. 6626-25, the new



patch is constructed with a square-woven nylon mesh fabric sandwiched between two layers of top quality uncured rubber. This nylon fabric reinforces the patch and prevents repairs from "blowing through" in cases of severe impacts or jolts to the tire.

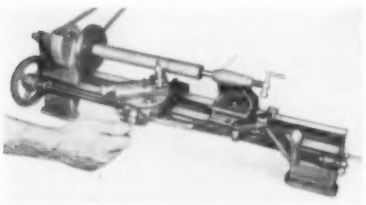
The patches come 25 to a box together with one electric heating element. Extra filler rubber is also included.

(Use Reply Card for Further Information)

Bench Engine Lathe

A new high-quality bench engine lathe capable of precision work on metal, wood and/or plastics, is announced by King Corp.

Although small and compact (bed length 30″; cutting range 20″; swing



7″) the "Little Giant" is of rugged production design and steel construction. Power requirements are ¼ hp. at 1750 r.p.m. Featured is a three-speed pulley.

Bed ways are machined with double Vs to 60°, its compound swivels 360° on a center pilot and is locked with two T-slot bolts. A hollow tapered driveshaft accommodates boring tools, tapering cutters, etc.

The lathe comes equipped with two male and two female centers, face plate driving dog, cutting tool and an armature driving dog, but without

(Use Reply Card for Further Information)

Protects Cars in Storage

Arco Spray-Wrap, a new cocoon-like coating, is said to protect automobiles stored in the open against rain, snow, sunlight, foundry dust, etc.

The coating is easily sprayed over the entire automobile, including chrome, stainless steel, or glass.

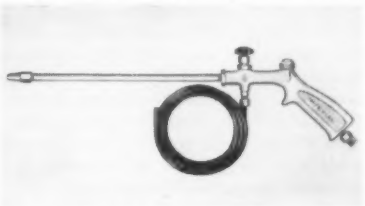
This new coating, which is easily removed from cars on the wash rack as they are being cleaned up for delivery, is said to give complete protection to cars while in storage and eliminates costly clean-up time as it prevents deterioration of the paint film, as well as pitting of chrome and bright work.

(Use Reply Card for Further Information)

Light-Weight Engine Cleaner

A new engine cleaner, stated to be over 40% lighter in weight and far easier to use, is announced by The Imperial Brass Mfg. Co.

The cleaner uses a powerful spray of kerosene or other solvents and compressed air to quickly remove dirt



and grease from automobile engines, equipment, parts, etc.

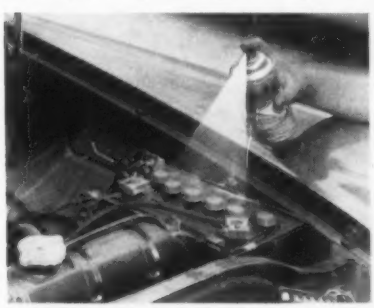
Because of its aluminum alloy construction, it is over 40% lighter in weight than previous model, and its streamlined handle is scientifically designed to provide the proper angle for convenient operation. A flexible, light-weight Tygon tubing is used for drawing solvent directly from solvent container.

Air flow is controlled by a thumb button and the amount of solvent is regulated by a needle valve. Flow of solvent can be shut off completely so that air can be used for dusting or drying. Durable bright nickel finish assures lasting attractive appearance.

(Use Reply Card for Further Information)

New Protective Spray

The B.O.M. Co. announces Bom-Kote Automotive Spray-Seal, a colorless preservative in 12-ounce pressurized containers, for protecting parts, motors, battery and ignition systems



against corrosion, rust, salt water and heat.

According to the manufacturer, Bom-Kote will not chip, crack, peel or darken with age; dries to the touch in 15-20 minutes with a high luster; and sets firmly within 3 days. It is a non-conductor of electricity.

(Use Reply Card for Further Information)

Oil-Dri Absorbent Dispenser

A new all-steel mobile dispenser unit that combines "on the spot" Oil-Dri absorbent dispensing with refuse picked up has been announced by the Oil-Dri Corp.

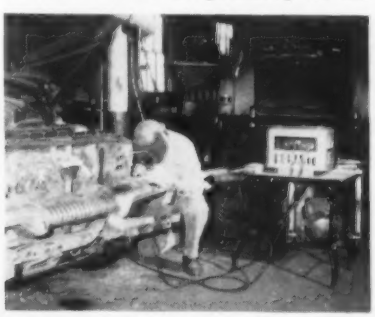
It "rolls to the job" on noiseless, swivel wheels, saving time and reducing shop maintenance costs. Combination automatic dispenser and detachable waste receptacle has a screen top for salvaging re-usable Oil-Dri absorbents from picked up waste.

Slot type release automatically delivers absorbent to dispenser floor for easy pickup. A handy side bracket holds shovel or scoop.

(Use Reply Card for Further Information)

100 Amp. Welder

Although the low cost "Handy Andy 100" arc welder is manufactured by Hobart Brothers Co. primarily for the



home workshop, it is finding its way into the automotive service field, as evidenced by this illustration, which shows it being used to repair an auto bumper bracket. A discarded roll-away type writer stand makes it portable and the fact that it can be operated on any standard 110/220 volt, single phase circuit, fused for 30 amps. makes it convenient to use anyplace in the shop. It has a 100 amp. capacity.

(Use Reply Card for Further Information)

These are new *manufacturers' products*

Wheel Balancing Cones

A set of radii cones for Bear off-the-car balancers is announced by the Bear Mfg. Co. which are especially designed to fit the contour of the bear-

ing race on those cars having wheels equipped with ball bearings. This is said to be particularly important on late model cars with the smaller wheel bearings because a greater degree of accuracy can be maintained.

The complete set of five radii cones fit all present model cars and work equally well on those wheels with roller bearings.

(Use Reply Card for Further Information)

Anco Anti-Lift Wiper Arms

A new windshield wiper arm is announced by The Anderson Co. which introduces for automobiles the wide-

range "spring toggle" pressure adjustment engineered by the company and proved successful on the swiftest aircraft.

Designed especially for today's sleekly curved windshields, this replacement arm, appropriately called the "Anti Wind-Lift Arm," effectively combats wind lift, skip-wipe and snow pack.

With a simple screwdriver adjustment, the arm pressure can be customset to keep the blade hugging the glass even at superhighway speeds. It not only provides the cleanest possible wipe but is said to make blades last longer before starting to streak.

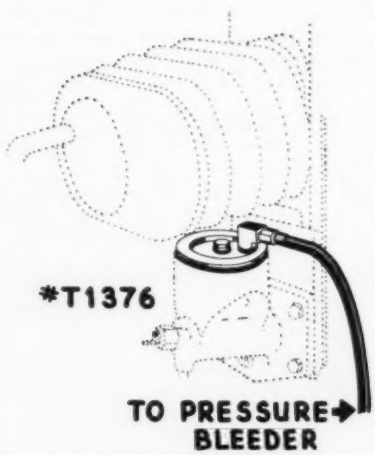
According to the recommendations of safety and automotive engineers, a wiper arm should exert one ounce of pressure per inch of wiper blade length for a good clean wiping job under all weather conditions. Recent tests on 1700 automobiles in several cities, however, clearly indicate that over 90% of the cars on the road fail to meet that safe-driving standard.

The new Anco Anti Wind-Lift Arm comes in two universal models to "quick-fit" all drum head (Model DH) and screw head (Model SH) wiper shafts beginning on 1941 cars. These arms are fully extensible from 10 to 14 inches and replace all left-hand and right-hand arms.

(Use Reply Card for Further Information)

Pressure Bleeder Adaptor

A new pressure bleeder adaptor to fit all Chrysler product cars with the open bowl master cylinder reservoir for the years of 1955, '56 and '57 is



now available from the Eis Automotive Corp. It will fit regular as well as power brake equipped cars.

Known as Part #T1376, it can be used with all Eis pressure bleeders, regardless of age.

(Use Reply Card for Further Information)

Cooling System Conditioner

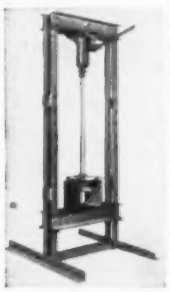
Rust Master Chemical Corp. announces Rust Master Royal with Sealite which is said to prevent rust in the cooling system by keeping minute particles in suspension where they are absolutely harmless, rust-proofing the system for one year. Its magic, Seal-ite is said to seal all radiator leaks, preventing the loss of anti-freeze; in addition, the product lubricates the water pump to improve water circulation. It is also said to clean out car heaters and protect aluminum cylinder heads.

The product contains no acid, caustic or strong alkali, is non-poisonous, nonflammable and absolutely harmless to rubber and paint.

(Use Reply Card for Further Information)

Axle Bearing Fixture

The Frank N. Wood Co. has added an axle bearing fixture to the line of special attachments which are used with the Trucut hydraulic general purpose press. This axle bearing fixture is designed to facilitate the quick and easy removal of axle bearings, and is used only with the floor model of the Trucut hydraulic press.



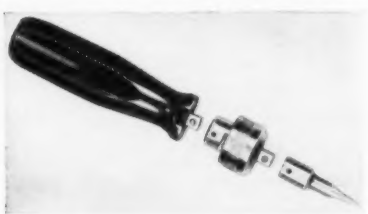
This utility press is a low-cost, compact general purpose shop press, of particular value to automotive repair shops because of its special attachments for handling a variety of automotive jobs.

(Use Reply Card for Further Information)

Tool of 101 Uses

This Herbrand Ratchet-Driver includes a quarter inch drive handle, a completely sealed quarter inch ratchet that has fingertip control for reversing and a 3/16" slot screwdriver bit.

Further versatility lies in the fact that all of Herbrand's quarter inch



drive attachments are interchangeable. The series includes slot screwdriver bits from 3/16" to 3/8" wide and from 1 5/8" to 3 1/4" long, Phillips bits No. 1, 2 and 3, 6 and 8 point sockets with openings from 3/16" to 9/16", extensions 2" and 5 1/2" long, an offset handle and a universal joint.

(Use Reply Card for Further Information)

Air Impact Wrench

A new Sioux air impact wrench is announced by Albertson & Company, Inc., which has been designed to deliver up to 15% more torque while consuming 30% less air.

Several mechanical improvements are featured to insure extra dura-

bility in the new wrench. An example is the powdered iron bearing surfaces on motor end plates to give longer wear and a closer air seal, as well as substantial ball bearings which contribute to long, smooth running. Also, simplified design has eliminated much of the metal-to-metal friction normally present in tools of this type, and fewer moving parts results in greater power, efficiency and longer life.

A power regulator with five settings permits running a series of nuts down to the same degree of tightness, and an angle attachment is available for reaching the ratchet wrench spots. A molded rubber ring protects the nose of the wrench, and a convenient wire hanger permits hanging when not in use, or for use in a suspended position.

Two models are available: Model 315 has a ½" drive and a ⅝" bolt size capacity; Model 317 has a ⅝" drive and a 11/16" bolt size capacity.

(Use Reply Card for Further Information)

Battery Booster Cables

To eliminate pushing or towing to start stalled cars—particularly cars with automatic transmissions—Walker

Brothers now are offering battery booster cable sets in a choice of lengths (8 to 15 ft.).

The cables are made with 6 or 4 gage copper or 4 gage aluminum conductors, with plastic or rubber insulation and equipped with heavy-duty, color-coded alligator type clips.

(Use Reply Card for Further Information)

SunScope Motor Tester

A new concept in automotive testing is featured by the Sun Electric Corp. with the introduction of their new SunScope Motor Tester.

Combining the quick-check advantages of the oscilloscope for visual analysis of an engine's ignition system with the precision pin-pointing of hard-to-find engine troubles possible only with meter equipment, this completely AC powered unit provides the automotive repairman with a full range testing laboratory as modern as today's cars.

Such operations as secondary ignition analyzing, checks for insulation breakdown and resistance, coil and condenser testing, manifold vacuum

tests, distributor dwell and point action, air-fuel ratios and other combustion functions are quickly and accurately performed with this test stand.

The testing unit is mounted on a steel console-type cabinet equipped with casters for easy mobility. Accessories furnished include vacuum fittings and adapter kits, jumper leads, exhaust condenser and hose, pick-up transformer adapter and solenoid starter switch. A fully-illustrated, easy-to-understand instruction manual is supplied with each tester.

(Use Reply Card for Further Information)

Nylon Tow Strap

An inexpensive nylon tow strap is announced by the Harry Buckles Co. to take the place of a tow chain or cable.

The tow strap is a handy, easy-to-use item that can be stored in the glove compartment of the vehicle. Made of 100 per cent DuPont nylon webbing, the strap weighs one pound two ounces, is only eight feet long, and is quickly and simply installed.

Jerks and jolts are minimized because the tow strap stretches and recovers twenty inches to help absorb the shock of starting and towing. To attach the tow strap, the buckle is snapped into place anywhere along the lower edge of the bumper. The strap is impervious to oil and water and has a safe working load of 5500 lbs.

(Use Reply Card for Further Information)

Fluorescent Inspection Kit

Now, a completely portable Fluorescent Penetrant Inspection Kit is available for locating cracks, pores, leaks and other defects open to the surface in any solid material. This kit, known as the Zyglo ZA-43, contains the most sensitive of the Zyglo materials—all in push-button, pressurized spray cans. It complements a wide variety of nondestructive test systems developed and sold by Magnaflux Corp.

Included in the kit's steel carrying case are: pressurized spray cans of cleaner, penetrant, and developer; a 100 watt high intensity black light; cleaning cloths; wire brush; and detailed instructions.

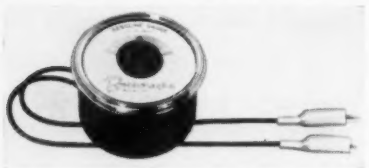
In testing with Zyglo, penetrant is sprayed on the surface of the part to be tested, and time is allowed for capillary action to draw the penetrant into any crack or porosity. Cleaner is then used to remove penetrant from the surface. By applying a thin film of spray-on developer, the fluorescent penetrant is drawn to the surface from any crack or pore. The portable, (115 volt) high intensity black light locates every defect as a glowing fluorescent indication.

(Use Reply Card for Further Information)

These are new *manufacturers' products*

Gas Gauge Tester

A new gasoline gauge tester is being offered by Borroughs Tool and Equipment Co., which makes possible fast, profitable servicing of gasoline gauges, tank units, and accompanying wiring.



In the past, the manufacturer explains, it has been a time-consuming operation to determine the cause of faulty gasoline gauge readings. Sometimes the gas tank had to be dropped and drained, new tank unit substituted, new gauge installed for testing, etc.

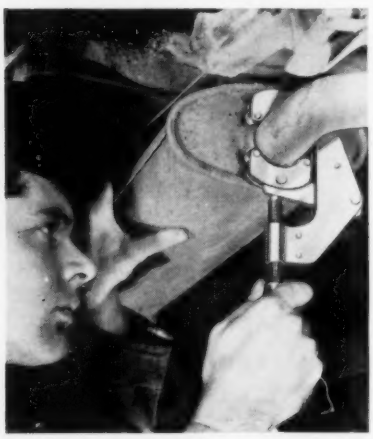
This tester is said to positively and quickly check the calibration of the gasoline gauge, the wire which connects the gasoline gauge to the tank unit, as well as the operation of the fuel tank unit itself, all without removal of either the tank unit or the gasoline gauge.

(Use Reply Card for Further Information)

Exhaust System Cutter

"Spee-D-Kut," a new pipe cutter designed to save time and money in the removal of mufflers and pipes, has been introduced by the Walker Manufacturing Co.

Developed to replace the old-fashioned hacksaw method of exhaust system removal, "Spee-D-Kut" is fast, safe and easy to use. It is particularly helpful in removing welded exhaust assemblies where the muffler must be cut from the pipe to make a new installation.

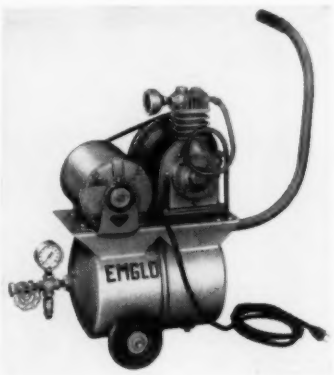


Combining attractive design with utility, the new cutter features a streamlined frame which provides ample clearance for operation in hard-to-get-at places. Four tool steel rollers cut cleanly and accurately—adjust automatically to cut pipes from 1¾" to 2½" in diameter. The knurled, screw-type handle applies pressure evenly to all cutters for proper tracking as the tool is operated in a free-swinging arc. Pipes are left clean as a whistle—free from burrs for fast, "gas tight" installations.

(Use Reply Card for Further Information)

Portable 1/3 hp Compressor

To meet the need for a small portable air compressor, Emglo Products Corp. announces the "Port-O-Glo"—a single cylinder piston type compressor mounted on a three gallon tank and driven by a 1/3 hp. motor. It is said the machine will produce 100 p.s.i. for such purposes as tire inflation, paint spraying, cleaning, operation of air driven tools and cylinders and other compressed air requirements.



The compressor is furnished with two wheel portable mounting, push handle, 8 foot cord set, pressure gauge, relief valve, shut-off valve and drain valve.

(Use Reply Card for Further Information)

Tool Kits Make Lasting Gifts

A wide range of attractive tool kits aimed at the gift market are announced by Utica Tool Division of Kelsey-Hayes Co. The kits range in size from a single all-purpose tool to a half-dozen of various designs. All of the packets come in vinyl or leather finish on which imprinting in white or gold letters is available, either with the name or the message of the giver. The selection is varied to the degree that proper useful tools are available not only for the home workshop, but the household kitchen, the office or store as well.

(Use Reply Card for Further Information)

Disributor-Carburetor Tool

A new combination tool for adjusting distributor dwell angle and carburetors on late-model G.M. V-8 cars and trucks with engine running, is announced by the Owatonna Tool Co. By merely switching the adjusting tips, the same tool can be used for either purpose.

The tool is 19½" long with a 45° angle at the tip end to facilitate reaching down and around various engine accessories. Since adjustments are made with the engine running in both cases, this feature enables work to be done without danger of burned hands on hot manifolds or hot wires and without removing the air cleaner. By simply turning the knob at the handle end of the tool, extremely fine adjustments can be made quickly and easily.

(Use Reply Card for Further Information)

Say You Saw It In
Automotive Service Digest

Oscilloscopes . . . *(Continued from page 42)*

trace before "Points Close" and after "Points Close" is proportional to the primary ignition voltage. This will be 6 volts on 6-volt ignition systems or about 9 to 12 volts on 12-volt systems with a series resistor in the primary circuit.

The Dwell can be measured fairly accurately by controlling the width of one cylinder trace so it is just the length of the scale on the screen. This scale is marked "O" to "100," representing per cent of dwell. On properly timed engines, the dwell will be from 55% to 65%. This percentage multiplied by the distributor angle per cylinder, that is the angle from point to point of the distributor cam lobes (60° on 6-cylinder engines, 45° on 8-cylinder engines), will give the dwell in degrees of distributor shaft rotation. Thus, 55% of 45° is 25°, or 65% is 29°, which is about the average range of dwell specifications for V-8 engines.

DWELL LINE PROPORTIONAL TO DWELL PERIOD

If there is other than a clean line as the points close it indicates bouncing or arcing points. Also a disturbance in the pattern at the end of the Dwell line, as the points open, indicates arcing of the breaker points.

The length of the Dwell line is proportional to the actual dwell period. When all the traces are shown on the screen, the lengths can be compared and checked for variations which would indicate either an unequally worn distributor cam, a worn or bent distributor shaft, or a cam loose on the shaft. This can be more definitely shown on the composite trace of all cylinders superimposed, discussed in the following paragraphs.

Composite Trace: By connecting the trigger lead to the HT conductor from the center of the coil to the center of the distributor cap, the pattern of the trace on the screen will represent all the cylinders super-imposed. For comparative purposes this trace is the most informative. Furthermore the trace by means of the Coarse Speed and Fine Speed controls, can be widened out so much that if the screen were large enough, it would be 12″ to 14″ long from left to right. However, by using the Left Edge control, each portion of the trace can be brought into view.

It appears to us that the most productive procedure in using the Heath ignition analyzer would be to (1) get all the traces on the screen by triggering from No. 1 spark plug, and after observing them; (2) open up the traces to about 1½″ each, and move them across the screen, observing carefully each phase of the trace; and then (3) move the trigger lead to the center HT wire and get a composite trace. Open this trace up as wide as possible and get the Spark zone and Coil-Condenser zone on the screen for observation.

The composite trace will show if something is wrong, but will not identify the cylinder or cylinders that may be defective. This can be done by moving the trigger lead to each spark plug wire in turn, with the controls set to give the expanded pattern.

Following this, the tune-up operations can be carried out, using the test instruments in the usual way. After the tune-up the work can be quickly checked by once more getting the composite trace and observing the indications.

* * *

It has been reported that the aromatic contents of some of the new premium-grade fuels (said to run as high as 60% of the ingredients), are causing an increase in fuel system seal failure and fuel pump troubles due to the fact that the aromatics cause rubber seals to swell and deteriorate.

●

The New

K. O. Lee Valve Guide Reaming Sets

Designed to service late model engines which have valve guides cast as part of the cylinder head. In this new type head, it is the valve which has to be replaced. This is accomplished by reaming out the valve guide for oversize stem valves. Most of the engine and valve manufacturers now offer at least three sizes of oversize valves.

The Lee Reamer Guide provides a true alignment with original guide bore using Lee Self-expanding pilots. The reamer is held rigid with reaming bushing during reaming operation. Simple to operate and extremely accurate.

Special sets available to service Ford, Mercury, Lincoln, Chevrolet, Plymouth, Dodge, DeSoto, Chrysler.

R55 Reseater Power Drive adapts to these valve guide reaming sets.

Clip ad to your letterhead and send for Literature.

K. O. Lee Company, Aberdeen, S. D.

PRECISION TUNE-UPS
guarantee satisfied customers!

the original *precision ball bearing* distributor plate

● For profits PLUS, use DYNA-FLYTE—the simple-to-install distributor plate that lets you perform fast, precision tune-ups to meet the critical demand of today's high compression engines.

● DYNA-FLYTE's fully hardened and ground ball bearing eliminates the WOBBLE, STICK and TILT of inferior or worn distributor plates and puts precision in the heart of the ignition.

● A DYNA-FLYTE in the distributor lets you SELL your customers peak performance with greater economy—easier starting, smoother idle, better acceleration and longer point life.

●

SINGLE AND DUAL POINT MODELS AVAILABLE FOR MOST POPULAR CARS AND TRUCKS!

For further information, write . . .

RENBERLES PRODUCTS
18606 FITZPATRICK AVENUE • DETROIT 28, MICHIGAN
or see your parts distributor.

Automotive Clinic . . .

(Continued from page 8)

vent uniform cooling of the cylinders, allowing hot spots to form at which steam is generated.

Another possibility is that the cylinder head has not been torqued evenly or to specifications and under certain heating conditions the head and/or block may be distorted just enough to allow gas pressure from the cylinders, or one cylinder, to get into the water jacket.

A third possibility is that there is a crack in the block which only opens under certain conditions of temperature, allowing cylinder pressure to get into the water jacket.

If there is a dynamometer anywhere within reasonable distance, the thing to do would be to run the engine under heavy load on it and see what happens. If the coolant starts to be discharged, shut off the dynamometer, but with engine idling, make a careful examination of the block, radiator and hoses.

Check the radiator to see that there are no cold spots which could interfere with coolant circulation. Feel all over the engine block to see if you can locate any hot spots. Torque the head to specification and check the normal water level to see if any water is being lost. Drain the oil to see if there is any water in the oil pan.

Another possibility is a hole in the casting which, under heavy load allows explosion pressure to get into the water jacket. If there are any scotch-plugs in the cylinder block, it may pay to knock them out and thoroughly flush out the water jacket.

Interchanging Engines

We have a 1953 Dodge V8 convertible equipped with a gyro-torque transmission. Both the engine and transmission are giving us trouble, and we would like to install either a '55 Dodge V8 or '56 Dodge V8 with standard transmission—preferably the '56 engine.

Can you give us some information pertaining to installation of each of these engines, and also let us know if the present rear end will be suitable with a standard transmission. If it is too much trouble to connect the transmission linkage to the lever on the column we would like to know what early model Dodge or Plymouth floor-shift could be used.—*W.M.L., Paxton, Mass.*

Answer: Since the 1953 V8 and the 1954 are practically the same engine, with 3 7/16" bore and 3¼" stroke, we would suggest putting in the 1954 engine and conventional transmission. To simplify the transmission control linkage the best thing to do would be to get a used steering column and gear box off a 1953 and put it in place of the present steering column and automatic transmission.

We do not have the rear axle specifications for the 1953 Dodge convertible, so you will have to refer to a Dodge shop manual for this information. Probably the ratio will be somewhat low for a conventional transmission and may make acceleration a little sluggish, but it will give better fuel economy.

Hard Starting When Hot

A 1953 Mercury in our shop starts on the first turn in the morning, but after driven for a few miles and let stand for an hour or two it takes more than a dozen turns of the starter to get it going again.

I installed new plugs, points, condenser and checked the coil and all of the wiring. Took it over to my buddy at a local Mercury garage and he cleaned the carburetor and said that everything checks out okay. But it still is hard to start when hot.—*O.A.W., Grants Pass, Ore.*

Answer: The condition you describe is typical of those cars and there is not a thing you can do about it. The

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NEW!
EIS Filler-Type CUPS with Xpanders for vertical-mounted cylinders.
ASK YOUR JOBBER ABOUT ALL EIS CUPS!

writer has a '55 Mercury Montclaire and has the same trouble, only not quite as bad, since the condition was improved on the '55 models.

Apparently the gasoline percolates out of the carburetor when the engine stands and creates a flooded condition. This requires from six to twelve turns of the engine to get the mixture normalized so it will be in the explosive range.

While it is not a satisfactory condition, you can be sure the engine will start after the required number of turns, so don't spend any more time on trying to improve the situation.

Install Power Steering?

Is there some way I could install power steering on a 1951 Olds . . . maybe with some minor modifications?—*J.R.Q., Shreveport, La.*

Answer: To our knowledge, about the only way you could install power steering on the '51 Olds would be to use a linkage type which could be adapted to your present steering linkage.

It is possible the 1953 Olds power steering pump could be used as a source of pressure, and a Bendix linkage unit, such as used on Ford cars, be used for operating the steering linkage. A control valve such as used on Ford cars would also have to be used. We believe this system could be worked out by making some modifications and adaptations.

"Pops" on Acceleration

Am having trouble with a six cylinder, 1955 Chevrolet (standard transmission) with 22,000 miles on it.

Whenever the throttle is opened to any extent, there is a steady "popping" through the carburetor, as if an intake valve were burned. On the road there seems to be no noticeable miss, but when accelerating the "popping" is very pronounced, and a slight loss of power can be felt. The trouble is present whether the engine is hot or cold. The car idles exceptionally well and also runs quietly, except when accelerating or pulling up a grade at open throttle.

So far I've checked compression and found all cylinders equal and good; thoroughly checked the ignition system, paying particular attention to any condition which might cause cross firing, and have gone over the carburetor thoroughly. Valve lash is .008" on the intakes and .015" on the exhausts. Also, a check does not show any restriction in the exhaust pipe, muffler or tailpipe.—*R.B., New Paltz, N. Y.*

Answer: From your description it appears as though one of the valves is hanging open intermittently. One way of overcoming this is to take kerosene with about 25% of Pyroil A mixed with it and pour this mixture down the throat of the carburetor about a teaspoonful at a time while the engine is running, opening the throttle wide for five seconds or so.

Although you state you have already checked against the possibility of cross firing, would suggest you carefully check this again. Remember, due to the higher compression in the cylinders, there is also higher voltage in the ignition secondary circuit which could cross fire under this condition, where it would not under idling condition.

If the condition persists, about all you can do will be to pull the head and check each intake valve for bent valve stem, if the valve faces and seats are all in good condition.

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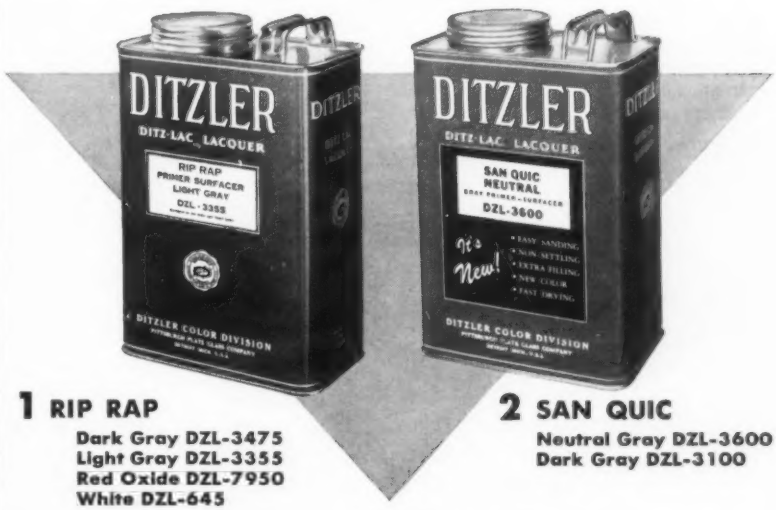

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SLIDE-SOUND COLOR FILM . . . entitled "20,000 Volts Under the Hood" covers the complete ignition circuit. It consists of a 35 mm color film, a 12" record, and a leader's guide containing suggested meeting procedures. The film shows with simplified illustrations the internal construction and operation of a battery, distributor and ignition coil and explains in non-technical terms how these units work together as a team to make up the ignition circuit in the modern automobile. Running time is 12 minutes.

The film kit consists of film, record and meeting guide. It may be purchased for $6.00, or it may be borrowed and returned after each showing at no charge except for return postage. Write to: Tech Editor, Delco-Remy Div., General Motors Corp., Anderson, Ind.

HYDRAULIC LIFTS . . . 12-page, 3-color catalog gives complete details on 16 models of lifts recommended for lubrication and other service and repair jobs. Major attention centers on the newly streamlined Rotary Roll-On which has been given a low silhouette with tapered runway flanges to provide additional under-car clearance for modern close-to-the-ground cars. Other lifts described include the frame pick-up, single plunger free-wheel, and two-plunger free-wheel which is available with three types of superstructures to handle heavy trucks and busses as well as passenger cars.

Write to: Dept. A, Rotary Lift Co., 1054 Kansas, Memphis 2, Tenn.

VALVE SERVICE . . . 20-page manual gives directions for reconditioning both soft and hard valve seats on 50 different makes and more than 500 model variations of internal combustion engines. Recommended sizes of pilots, grinding wheels, or stones are listed for each engine.

Write to: Thor Power Tool Co., 175 N. State St., Aurora, Ill.

MUFFLERS . . . Thermo Flo muffler design and construction features are described in new catalog . . . together with complete list of mufflers, tail and exhaust pipes, muffler clamps and hangers, as well as other exhaust system parts.

Write to: Arnold Haviland Co., Defiance, Ohio.

BRAKE SERVICE . . . More than 8,000 individual listings of brake lining are included in this new 50-page, 1957-58 catalog. Also listed is brake servicing equipment such as an automatic power binder, a speed grinder and a curing oven, as well as parts and accessories used in brake lining installation.

Write to: Grizzly Manufacturing Division, Pauling, Ohio.

DISPENSING EQUIPMENT . . . New pocket-size catalog gives complete model and feature descriptions of Bennett gasoline pumps, Eco Tireflators, Eco dispensers, kerosene dispensers, barrel and skid tank pumps and grease dispensers. The 66-page booklet contains complete price lists and a convenient thumb-index for easy reference to each group of products.

Write to: Advertising Department, Bennett Pump Div., John Wood Co., Muskegon, Mich.

HYDRA-MATIC SERVICE . . . 250-page "picture story" transmission service manual takes the "mystery" out of the Hydra-Matic transmission. Covering all Hydra-Matic models from 1956 to the present, the new 8" x 11" manual carries more than 600 photographic how-to-do-it illustrations and diagrams to guide mechanics every step of the way through all service

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procedures. The manual also explains and illustrates, step-by-step, what parts and tools to use. At the same time the manual provides quality control checks at all important points of assembly.

Other features include a complete schedule of flat rate charges listed in handy, quick-reference tables. The covers are durable and grease-resistant, and the binding is designed to open wide and lie flat while in use.

Write to: United Motors Service, Division of General Motors, Detroit 2, Mich.

FILTER WALL CHART . . . A 1958 Automotive filter wall chart is now available which lists replacement fuel filters as well as oil and air filters for all stock models of cars and light trucks. The front of the chart gives the oil, air and fuel filter specifications for the more popular foreign made cars as well as late model domestic passenger cars and light trucks. The reverse side provides cross reference between Purolator refill numbers and thirteen other filter makes, stating brand name, type, model designation and dimensions.

Write to: Purolator Products, Inc., Rahway, N. J.

WELDING SUPPLIES . . . A new 48-page catalog contains over 100 illustrations and complete information on ferrous and non-ferrous welding rods for oxyacetylene welding and Heliwelding; welding and brazing fluxes and their applications; aluminum welding fluxes; Aircosil silver brazing alloys; brazing alloys; Jackson and Airco protective equipment; Jackson electrode holders and cable connectors; weld cleaning tools; twin and single line hoses; and many other items.

Write to: Air Reduction Sales Co., A Division of Air Reduction Co., Inc., 150 E. 42nd St., New York 17, N. Y.

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Calendar of Automotive Events

1958

Jan. 11-15—National Automobile Dealers Assn. Convention and Equipment Exhibition, Miami Beach, Fla.

Jan. 18-26—Detroit Auto Show, Artillery Armory, Detroit, Mich.

Feb. 3-6—Automotive Accessories Mfg. of America, Annual Exposition, Navy Pier, Chicago, Ill.

Feb. 20-23—Pacific Automotive Show, Pan Pacific Auditorium, Los Angeles, Calif.

April 5-13—1958 International Automobile Show, New York Coliseum, New York, N. Y.

May 11-14—Automotive Engine Rebuilders Association Convention, Sheraton-Park Hotel, Washington, D. C.

June 25-29—IGO-America 1958 Convention, Statler Hotel, Los Angeles, Calif.

Flightomatic Transmission Service Tips

According to Studebaker-Packard, some of the control pressure transfer tubes used in the Flightomatic transmission are now being made of aluminum, which can be damaged rather easily if they are not handled carefully. Therefore, care should be taken when removing or replacing the tubes so that they are not bent, distorted or ruptured by the use of a sharp screw driver, hammer or other tools.

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Design and Function of Rochester Carburetor Auxiliary Throttle Valve Assembly

The July, 1957, issue of AUTOMOTIVE SERVICE DIGEST contained on page 21 an article "Curing Carburetor-Caused Knocks," in which it was stated that noise could result from a loose auxiliary body assembly and could be corrected by shimming with a portion of a gasket.

Exception to the diagnosis and "cure" of the subject in question was taken by Rochester Products, since it involved the 4-barrel Rochester carburetor. In clarification of the design and function of the auxiliary throttle valve assembly, we submit the following from Mr. H. Gladding, Service Manager, Rochester Products:

"The auxiliary throttle valve assembly was designed to prevent raw air flow until fuel flow is established which provides the proper air-fuel ratio. In the early development, work was done with tightly fitted assemblies. Heat, uneven torques on screws, and other factors could distort the body of the auxiliary valve assembly causing either wide open hangup or the valves would not open. The design, therefore, was changed to allow a floating fit to assure proper operation.

"The noise referred to is attributed to up and down movement of the assembly in the bowl cavity. This condition has not been found by Rochester Products and, in fact, our service engineer visited the shop mentioned in the article and they could not demonstrate the condition.

"You will observe by examination of the assembled carburetor that all pressures are downward in operation, and the weight of the unit prevents movement when the secondaries are not operative. Therefore, no rattle *can* occur.

"Your last paragraph states that engine performance is improved due to elimination of air leaks after the 'fix'. Shimming the assembly to assure a tight fit against the bowl to throttle body gasket will have no effect on operation because:

1. The auxiliary valves merely limit air flow on cutting in the secondary bores and are not sealed at any time.
2. Secondary operation occurs at approximately 70 m.p.h. road load or at wide open throttle position. Under either condition there will be no change in engine operation whether or not the auxiliary assembly is tight.

"We trust this information explains the impracticability of your article and gives you an opportunity to publish the facts for your readers."

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U-Joints . . .

(Continued from page 53)

E-22. If the limits have not held, repeat operation E-19 until true.

E-23. Now remove the assembly to the welding bench and complete weld all around the tube (Fig. 15-16).

E-24. After completing the weld, put back in the lathe and indicate, holding recommended limits.

E-25. After welding, check the shaft for run-out and straighten by hydraulic jack method outlined under Straightening Drive Shaft. (Cross Type) (See Operation A-10.)

E-26. Remove the end yoke fixture assembled in operation E-14, then, reassemble the sleeve yoke. Welding can also be done in the lathe, but cover ways of the lathe for protection from the welding arc.

The retiring usher was instructing his youthful successor in the details of his office. "And remember, my boy, that we have nothing but good, kind Christians in this church—until you try to put someone else in their pew."

BRUSHING UP ON THOSE EASY-TO-FORGET THINGS

Refresher course

Ohm's law—the relation between current, E. M. F. and resistance

● WHEN AN ELECTRIC CURRENT is forced along a wire, the current is directly proportional to the electromotive force (voltage) of the generator or cell and inversely proportional to the resistance of the circuit.

This relation between current, electromotive force and resistance is called Ohm's law, dating back to 1827. The law can be stated: The intensity of the electric current along a conductor equals the electromotive force divided by the resistance. That is:

$$\text{Current (amperes)} = \frac{\text{Electromotive force (volts)}}{\text{resistance (ohms)}}$$

or, in symbols:

$$(1)\quad I = \frac{E}{R}$$

If, for example, it is necessary to find the intensity of the current sent through a resistance of 5 ohms by an e.m.f. of 110 volts, then:

$$I = \frac{E}{R} = \frac{110}{5} = 22 \text{ amps.}$$

If it is desired to find the e.m.f. required to maintain a certain current in a circuit of known resistance, then:

$$(2)\quad E = I \times R$$

Example: Find the voltage required to send 10 amps through a lamp if the resistance is 5.5 ohms. Then:

$$E = IR = 10 \text{ times } 5.5 = 55 \text{ volts}$$

When necessary to find the resistance to be inserted in a circuit so that current will have a given intensity when a specified voltage is applied, then:

$$(3)\quad R = \frac{E}{I}$$

Thus, suppose a heater can carry 10 amps. If the heater is used on a 115-volt circuit, what must be the value of its hot resistance? Then:

$$R = \frac{E}{I} = \frac{115}{10} = 11.5 \text{ ohms}$$

It is necessary that Ohm's law be memorized in its three forms because the law is fundamental and indispensable to the automotive electrician.

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Color in the Shop . . . *(Continued from page 26)*

vision are a distracting influence. Attention-arresting colors should be used sparingly to avoid undue distraction on the job.

- **Reflection:**—Large areas of dark colors will absorb valuable light. Colors with higher reflection values provide an even distribution of light. White has a high reflection factor and is usually recommended for ceilings, except in those cases where the intention is to cause a distrasting ceiling to recede into a neutral background.

- **Simplicity:**—A color plan selected for the automotive shop should be reasonably simple. A simple plan will not clutter up the paint inventory with little-used colors, neither will the painter's labor be spent on time-consuming, fussy details.

- **Practical:**—Colors used in the automotive shop should be practical. Very light or very dark colors are more easily soiled. Medium colors in grayed tones conceal soiling and, thus, maintenance work is reduced.

- **Purpose:**—Colors should be used for a purpose. As an example, bright red has long been recommended for fire-fighting equipment. If red is used for this purpose, its use on other pieces of equipment should obviously be avoided. If used indiscriminately, any particular color will have no significance.

- **Order:**—Color can be used to emphasize important objects. Various tones of gray can be used to subordinate unimportant objects. As a result, order is established and good housekeeping is encouraged in the establishment.

A review of the foregoing factors, upon which the selection of shop colors is based, emphasizes that the creation of a beautiful interior is by no means the purpose behind the use of color. However, an attractive interior will automatically be a natural outcome of the intelligent use of color.

EFFECT OF SHOP LAYOUT ON COLOR SELECTION

The shape and general characteristics of the shop building have an important influence on the selection of colors for the walls and ceilings.

Correct color placement can be used to change the apparent proportions of the shop service area. Long, narrow interiors may be made to seem wider by the use of darker colors on the end walls to make them appear to advance, and lighter colors on the long side walls to make them recede. The impression of monotonous proportions in a square room can be altered by painting the wall opposite the windows in a color value different from the end walls.

Strong light coming from one direction can be equalized or controlled by using two or three compatible wall colors. In a room that receives too much warm light from the south or west, the walls opposite the windows can be painted in a medium or darker value of grayed-green, blue-green, such as turquoise, or some other cool color to reduce glare. End walls which may receive less direct light can be painted in a lighter value of the color selected for the wall opposite the windows.

If the shop receives natural light from the north or east, or if it does not receive a sufficient amount of natural light, the colors used on the walls should be brighter and more stimulating. Warmer colors for this purpose are tan, ivory, peach, and even a light rose.

The ceiling can be painted in a soft white, ivory, or in a lighter tint of the wall color. Ordinary high ceilings can be made to seem lower by painting them darker than the walls. However, this may cause an unnecessary loss in the reflection values from the ceiling surfaces. Another good way to lower the apparent height of a room is to paint a darker dado section extending about three or three and a half feet above the floor. Light colors tend to increase the apparent size of a room. Darker colors often are used to make a large room appear smaller and more friendly.

Next month: "Selection and application of color patterns to shop and equipment."

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Correcting Rear Wheel "Click"

Occasionally a clicking or creaking noise develops in the rear wheel hub of the rear axle which is audible when the vehicle is moved from a dead stop. According to Willys Motors, Inc., if such a noise is noticed on their products, it has been found to be caused by looseness of the axle shaft nut, and can usually be stopped by tightening the nut to 150-175 ft.lbs. torque.

If the noise has been allowed to continue for a time, slight wear of the hub, axle shaft taper, key and keyway may result, and the noise will persist even when the nut has been tightened. In this case, the following white lead treatment may be effective:

Remove the wheel and hub, and the key from the keyway. Coat the hub, key, and keyway with white lead. Reinstall the parts and tighten the nut to the recommended torque. The lead will often act as a shim to compensate for the wear.

Should this treatment fail to stop the noise, it will be necessary to replace the worn parts. Should this be done, be sure to torque the nut properly to prevent a recurrence of the trouble.

When Doing a Complete Tune-Up Job —Don't Overlook Valve Lash

It has been called to our attention that the adjustment of valve lash, particularly on overhead valve engines, is often overlooked in an otherwise complete tune-up job.

Some servicemen are apparently under the impression that if tappets are relatively quiet, valve adjustment is

To use the gapping gauge while the engine is running at a slow idle speed, it is slipped over the top of the valve spring and its retainer, with the inner plunger just under the rocker arm. In this position it indicates the relative movement between the end of the valve stem and the end of the rocker arm, which is the valve lash.

satisfactory. Inspection in many cases indicates that settings are off by as much as .005" to .010", particularly on mechanical lifters. Since valve lash affects valve timing (and valve life), it's often surprising how performance can be improved through proper adjustment.

To assure an accurate setting, and eliminate guess work, the top-notch mechanic uses a dial indicator type valve gapping gauge, such as the one being used in the accompanying illustration.

Before Blaming Squeak on Ball Joint Check Torque of Control Arm Bushing

According to a recent Plymouth Service Bulletin, an improperly torqued upper control arm pivot bushing bolt can cause a squeaking noise which may mistakenly be blamed on ball joints requiring lubrication. The squeak is caused by rotation of the inner sleeve in the pivot bushings.

If such a condition is found, the factory recommends the application of a minimum of 55 ft. lbs. torque to the bushing bolts to exert a clamping force on the support brackets to prevent rotation of the inner sleeve in the pivot bushings.

If re-torquing does not correct the condition, it is possible the faces of the upper control arm support brackets may not be parallel. The distance between the faces should measure 1-49/64". If not, place the bracket in a vise and adjust to the proper dimension. Then replace the brackets and torque the bushing bolt to 55 ft. lbs.

SPRAY OR BRUSH ON

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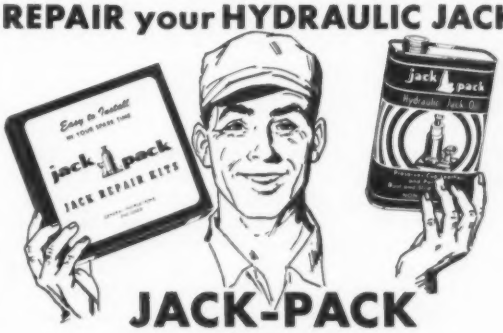

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- No more high freight charges.
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jack pack MFG. COMPANY

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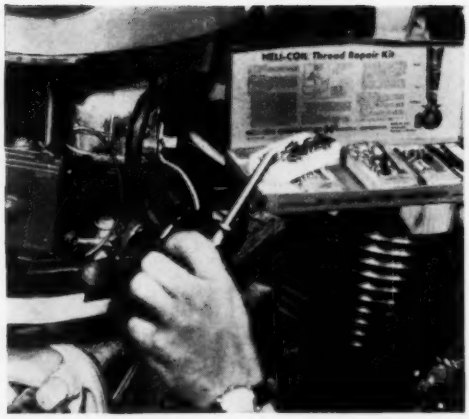


Fig. 7. Aluminum cowling tabs—a troublesome spot since engine covers are frequently removed and replaced. Here a mechanic is preventing future failure by installing stainless steel thread inserts.

Fig. 8. Tapping the drilled holes of a truck hub.

Threads *(Continued from page 57)*

wholesalers' stores. They come in practically all sizes to meet the needs of the automobile, boating, truck, bus, and tractor operators. Each kit contains a special Heli-Coil tap, inserting tool and supply of inserts.

SAVES TIME, MONEY ON BIG JOBS

On the heavy side of the picture where a stripped thread is not just an inconvenience to a motorist or a delayed fishing trip for a boater, we find these thread inserts doing quite a job for the farmer or the tractor mechanic, or the man who maintains heavy truck equipment.

One ready-mix concrete company ran into serious maintenance cost as well as serious disruption of schedules due to the breaking of wheel hub studs, which in turn damaged the hubs. When more than one stud broke on a wheel hub, it was necessary to braze or weld the wheel hub and redrill the holes in a new circle. The operation made it necessary to take the truck-mounted concrete mixers out of service for at least one full day, since the hub had to be removed and taken to a machine shop for repairs.

A more expensive, but sometimes necessary method was replacement of the hub at a cost of $40 to $50 each.

But with the stainless steel wire thread insert, the hub is repaired while in place on the vehicle — the time required being 20 to 30 minutes.

And here is how it is done. As is usual in this work, the hole with the damaged threads is drilled out. The nominal thread size of the insert to be installed is 5/8-11. So the hole must be drilled out to a minimum diameter of .653″ (maximum diameter .663″). This is necessary in order to completely clean out the hole before tapping.

The mechanic next uses a special tap to tap out the hole which is to receive the insert (Fig. 8). This tap is a part of the Heli-Coil Shop-Pack (for the 5/8-11 stud it is .7410″).

The final step is the installation of the insert. Fig. 9 shows the new threads provided by the wire insert after it is installed. Note that the insert does not require any significant sacrifice in wall thickness.

The strength of the reinforced hole is due primarily to the flexibility and insert. When a screw is tightened into it, the insert adjusts itself until all threads are carrying an equal share of the load. Because of its hardness and smoothness, the insert has a greater wear resistance than ground or tapped threads and will permit frequent screw removal without noticeable change in screw fit.

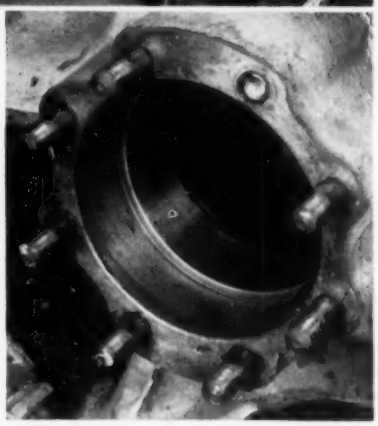
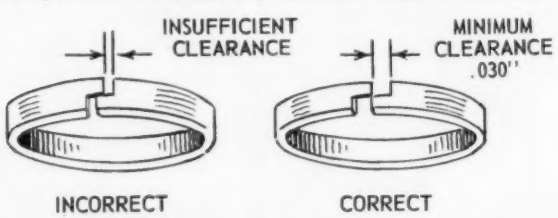


Fig. 9. The new threads provided by the wire insert after it is installed. Note that the insert does not require any significant sacrifice in wall thickness.

It should be evident that this type of speedy and permanent repair should be a tremendous business advantage to the bus operator, the truck owner, or the farmer.

Leakage Past Input Shaft Seal Rings Can Affect TorqueFlite Operation

To prevent leakage past the input shaft seal rings on TorqueFlite transmissions, the seal rings should have



proper clearance between the ends of the ring lock, and should be perfectly round (when in the installed position) so that they seat firmly on the inner diameter of the reaction shaft. According to Chrysler Corp., this is very important, as leakage past these rings could affect front clutch operation. To check these seal rings, the service department suggests the following procedure.

1. With the seal ring in a free position, hooked ends engaged, end clearance should be *a minimum of .030″*, as shown in sketch. If end clearance is insufficient, install a new seal ring with correct clearance.

2. Insert seal ring squarely in the inner diameter of the reaction shaft. The ring should be concentric with diameter of the reaction shaft, when in the installed position, so that no space or gap shows between the ring and shaft. If any gap exists, indicating that the ring is not perfectly round and seating against the shaft at all points, install a new seal ring after checking the above.

If a TorqueFlite transmission is disassembled for any reason, Chrysler suggests the input shaft seal rings be checked as outlined above before reassembly.

DeSoto Stresses Importance of Ignition Timing on '58 Models

With the increase in compression ratios on the 1958 DeSoto Turboflash engine, DeSoto's Service Department states that it is more important than ever that ignition timing be correctly set before any extended operation of the engine.

Therefore, it is recommended that ignition timing on these engines be checked and set by the use of a timing light to the following specifications:

Model	*Setting*	*Engine RPM's*
LS-1, LS-2, LS-3	6° BTDC	450-500
LS-3 Adventurer	8° BTDC	650-700

Due to atmospheric conditions and the type of fuel available in certain areas, a variance of ±4° in the above specs may be necessary for efficient engine performance.

Grips the screw!
Drives it too!
Quick-Wedge
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SCREWDRIVER
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HE WHO LAUGHS, COME WHAT MAY,

WILL LIVE TO LAUGH ANOTHER DAY

Short circuit smiles

Three rabid pro-football fans went to all the games their favorite team played. One day, with a crucial game scheduled, two of them showed up in their regular seats. The third was absent, for the first time in memory.

"Where's Joe?" Fan No. 1 asked.

"Haven't you heard?" No. 2 said. "He's getting married this afternoon. At 2 o'clock."

"Getting married at two o'clock!" exclaimed No. 1. "What a dope! That means he won't be able to get here before the second half!"

★ ★ ★

A curiosity-ridden drunk stopped beside a deep excavation and called down to a small group of men working at the bottom of the pit: "Say, watcha doing down there?"

"We're building a subway," one of the workers shouted back.

"When you gonna finish it?"

"Three years," came the reply.

Three years!" muttered the drunk to himself, "To heck with it. I'll take a taxi."

★ ★ ★

The day after Macpherson's wife presented him with an offspring, the proud father was seen in the drug store purchasing a baby bottle.

"Man, that's scandalous extravagance!" said a fellow-countryman.

"It's necessary, though," sighed Mac. "The woman's gone and had triplets."

★ ★ ★

A drunk staggered into a bar one night and yelled in a loud voice, "When I drink, everybody drinks!" He summoned everyone to the bar—musicians, B-girls, waiters, and guests. When he finished his whiskey he shouted again, "When I take another drink, everybody takes another drink!"

Once again everybody gathered around the bar. They even called in the taxi drivers and doormen. When he finished that one the drunk took a dollar out of his pocket and slapped it on the bar. "When I pay," he screamed, "everybody pays!"

The young business tycoon fell in love with a nightclub entertainer and hired a detective agency to check up on her. A few weeks later he received the following report.

"The young lady has an excellent reputation. Her past is without blemish and she has many friends of good social standing.

"The only scandal associated with her is that she has often been seen lately with a business tycoon of questionable character."

★ ★ ★

If you don't think plain English can be confusing, how about this conversation, heard recently in a local hardware store.

"Do you have any four-volt, two-watt bulbs?"

"For what?"

"No, two."

"Two what?"

"Yes."

"No."

★ ★ ★

"Didja hear about the girl who didn't know the difference between vaseline and putty?"

"No—what happened to the girl who didn't know the difference between vaseline and putty?"

"All her window panes fell out!"

A married man we know quite well relaxed on a recent business trip by enjoying a lively weekend with a lively blonde. Not long after returning to the home office, however, a rather shifty individual paid him a visit and said, with the nasty innuendo of a professional blackmailer, "Remember that trip you took? Remember that blonde?" The answer to both questions was "Yes."

"Well, mister," said the unsavory one, "it just so happens that I have photographs of everything what you and her did."

"Everything?" gulped our friend.

"Everything! See, he spread a half dozen highly detailed snapshots on the desk and after giving them a chance to make the proper impression, asked, "What are you gonna do about it, mister?"

"Well," drawled our friend coolly, "I'll take one of these, two of those, and five of this one over here. Can I have them tinted?"

★ ★ ★

Wife: "Those new nextdoor neighbors are sure wonderful people. Notice how he kisses her when he leaves for work and keeps waving to her. Why don't you do that, George?"

George: "I would, honey, but I don't even know her yet."

★ ★ ★

Lawyer: "On what grounds are you seeking a divorce?"

Woman: "I think my husband's been unfaithful."

Lawyer: "And what makes you think so?"

Woman: "Well, I don't think he is the father of my child."

★ ★ ★

One day as I sat musing without a friend, a little voice said to me: "Cheer up, things could be worse." So I cheered up and, sure enough, things did get worse.

★ ★ ★

Here's a scene that took place on a crowded trolley. A young lady is vainly groping for her purse to pay her fare. A young man is standing nearby with anguish written on his handsome features.

Young man: "Pardon me, miss, but may I pay your fare?"

Young lady: "Sir!"

Young man: "I beg your pardon again, young lady, but won't you let me pay your fare?"

Young lady: "Why, I don't even know you and anyway I'll have this purse open in a minute."

Young man: "I really must insist on paying your fare. You've unzipped me three times."

★ ★ ★

He: "Would you sell yourself for a million dollars?"

She: "Why, yes, I think I would."

He: "Would you sell yourself for two dollars?"

She (shocked): "What do you think I am?"

He: "We've already settled that. Now we're haggling about the price."

You're

DOUBLE SURE

when you call for RAMCO 10-Up SETS because only RAMCO gives you CIRCUMFERENTIAL EXPANSION* CHROME OIL RINGS for any age engine!

To restore new car Get Up and Go in *any* engine, old or new — be DOUBLE SURE — call for RAMCO 10-Up Sets!

In every 10-Up Set you get either Chrome C-9 or Chrome Spiro-Seal oil rings — whichever are best for the engine.

Both rings have years-ahead *circumferential expansion action* — oil rings to repower *any* engine — old or new. Only RAMCO gives you *both* rings for both needs!

That's why you're DOUBLE SURE you repower *right* when you specify RAMCO 10-Up Sets.

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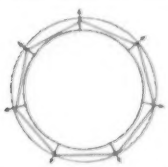
SEE WHY RAMCO'S CIRCUMFERENTIAL EXPANSION ACTION INSURES HIGH CONFORMABILITY, SIDE SEALING, SURE-FIRE OIL CONTROL.

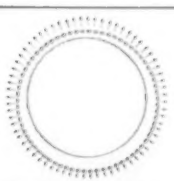


CONVENTIONAL OIL RINGS

Conventional oil rings have inner-rings which are limited to 6 or 7 outward thrusts to seal ring against cylinder wall.

CHROME SPIRO-SEAL OIL RINGS

The RAMCO Spiro-Seal segment utilizes an exclusive, years-ahead circumferential expansion principle which insures high conformability to cylinder walls. It works like a watch spring to adjust to taper or wear. Riding *independently of piston groove depth*, it provides equalized radial pressure against cylinder wall for positive oil control.



CHROME C-9 OIL RINGS

Here is the most advanced expression of the circumferential expansion principle. This newest advancement in ring design assures a new high in conformability. With an average of 60 outward thrusts, it adapts easily to cylinder variations and variable operating conditions, in both stop and go and high speed operations.

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